NEW ZEALAND
JOURNAL OF

AGRICULTURE

JULY
1960

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NEW ZEALAND

Journal of Agriculture

Vol. 101 No. 1 15 July 1960

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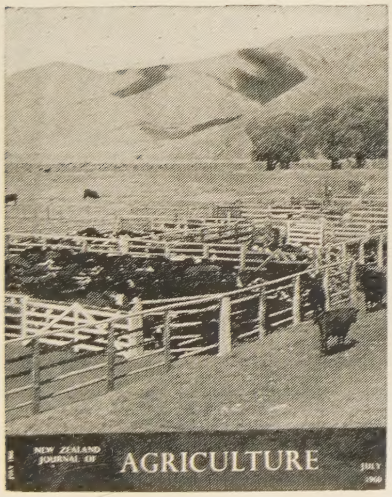

Drafting of cattle on Molesworth Station, Marlborough, is shown on our cover this month. The runs comprising the 450,000 acres of what is now known as Molesworth were taken up by graziers from about 1850 to 1880. As many as 50,000 sheep were carried by the 1890s, but from then on deterioration set in owing to repeated burning of the tussock, overgrazing with sheep, and the depredations of rabbits and deer. Molesworth and an adjoining run reverted to the State in 1938 and 1949 respectively. Sheep were removed from the area and after being spelled for two years it was stocked with cattle. In 1959 nearly 8,500 were carried.

[*Robin Smith photograph*

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HOPES and fears for agricultural research in New Zealand and suggestions on how to get all that can be expected from research were covered by Dr J. F. Filmer, Director of the Animal Research Division of the Department of Agriculture, in opening the 12th Ruakura Farmers' Conference Week at Hamilton last month. Appointed Director of the Division when it was formed in 1939, Dr Filmer is to retire later this year. His address, an adaptation of which follows, reflects his close association with and interest in developments in agricultural science and practice.

DR FILMER ASKS FARMERS:

Is Agricultural Research In New Zealand Worth While to **You**?

AUTUMN
WINTER
IDEALS FOR WINTERING
1. High autumn production.
2. Minimum hay and silage.
3. Cattle in good condition at calving.
4. Ample nutritious feed available after calving.
5. Minimum pasture dam
6. Suitable distribution
work.
AUTUMN
WINTER

SEVEN years ago when I gave the opening address to the Ruakura Farmers' Conference on the subject "Research and the Farmer" I asked and tried to answer two questions:

1. **How can research help the farmer?**
2. **What can the farmer do about research?**

I am going to speak to you on the same subject, but this time I will ask only one question and I will not try to answer it. I am going to ask New Zealand farmers to answer this question:

Is agricultural research in New Zealand worth while to you?

In his presidential address to the British Association for the Advancement of Science in 1948, the late Sir Henry Tizard said:

> I shall predict that unless the prevention of diseases among plants and animals and all other scientific problems of the supply of food are studied on the same kind of scale by men of similar calibre as are the problems of human health, chaos and misery will result.

Sir Henry was referring to the necessity for agriculture to step up its rate of production to meet the growing needs of a rapidly increasing world population. That problem is still with us and I believe that on a world scale we still have a long way to go to meet Sir Henry's challenge.

I believe, too, that even from a selfish point of view, New Zealand cannot remain indifferent to the threat of misery and chaos which inevitably follow hunger.

But I know that today New Zealand farmers are finding it rather difficult to obtain satisfactory prices for some of the things they produce. It is in this immediate and local situation rather than in the long-term worldwide sphere that I ask New Zealand farmers:

Is agricultural research in New Zealand worth while to you?

I have noted with interest the campaign by the dairy industry which was recently launched in the "Exporter" under the caption "lbs.-per-£". Let us then look first at the cost of agricultural research. While I want you to think of all aspects of agricultural research, I will draw my data from animal research for the sole reason that I happen to be more familiar with it than with other aspects of agricultural research.

Since 1939, when it was formed, the Animal Research Division has spent a total of over £4 million. The expenditure in 1939-40 was £45,000. By 1959-60 this had risen to £450,000, and of that total £258,000 was spent at Ruakura.

The whole of the money has been found by taxpayers of New Zealand and about a quarter of the total came from the taxes paid by farmers. It can be calculated that in 1959-60 the farmers' share of the cost worked out at about 0.01d. for every pound of meat, wool, and butterfat they produced.

But I do not give you that figure in an endeavour to belittle the expenditure; £450,000 per year is a lot of money and I often ask myself and sometimes ask my staff if New Zealand farmers are getting value for what we spend. . . . In 1951 Dr W. M. Hamilton, now Secretary of the Department of Scientific and Industrial Research, calculated that there was in that year a net gain to New Zealand dairy farmers of:

£600,000 from the use of penicillin in the treatment of mastitis;

£630,000 from the use of Strain 19 vaccine for the control of contagious abortion; and

£135,000 from the topdressing of peat land with copper.

Research Division's Contributions

A few more contributions made by the Animal Research Division in the past 20 years are listed in the following section.

Research Contributions

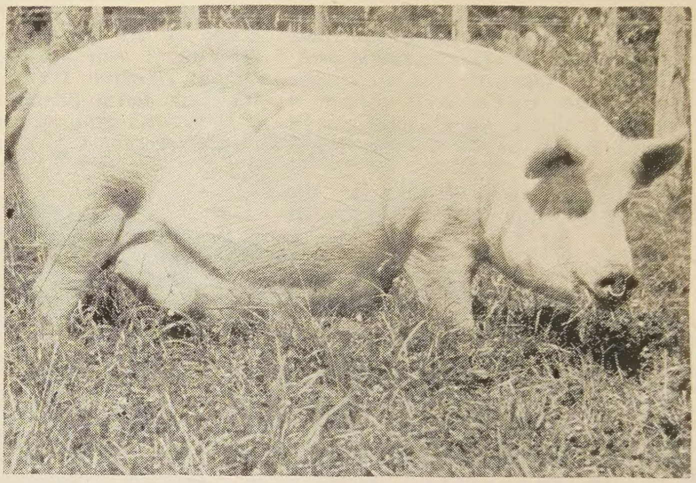
IT has been shown that healthy, well grown calves can be raised by rotating them ahead of the cows.

METHODS have been evolved for producing from 250 to 350 lb of butterfat per acre on a self contained dairy farm in a district where the average production is about 210 lb.

ARTIFICIAL breeding techniques were evolved which made it possible for 415,000 dairy cows to be inseminated this year from specially selected bulls.

DEVICES have been evolved which have increased the efficiency of milking machines and a paper at this conference will report the significant effect of efficient machine milking on butterfat production.

FOR the pig farmer, a very productive Large White x Berkshire hybrid has been evolved; a system has been provided which fits pig production to the availability of skim milk; and the round house has greatly reduced the mortality rate in piglets.



METHODS of diagnosing and controlling cobalt deficiency have been devised.

GOITRE in young lambs has been prevented by giving pregnant ewes one iodine drench three months after tupping.

RICKETS in hoggets has been controlled by giving one dose of vitamin D concentrate at the beginning of winter.

SELENIUM is promising to give spectacular results in preventing white muscle disease, one form of lamb ill thrift, and the low lambing percentage which sometimes accompanies these.

ACCURATE data have been provided concerning the effect of breeding and grazing management practices on the production of lamb and beef and it has been shown that 250 lb of meat per acre can be produced in a district where the average is about 150 lb per acre.

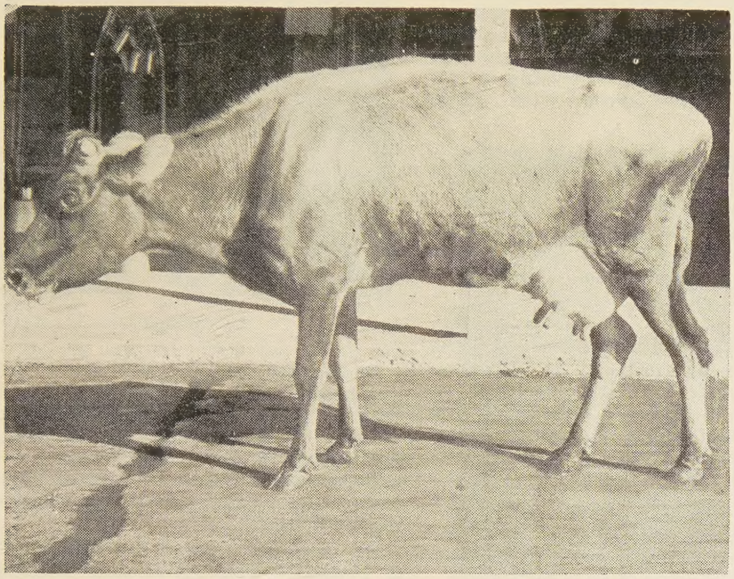
A SIMPLE method was evolved for preventing the post-dipping lameness which occurred when some of the modern insecticides were used in sheep dips.

EFFECTIVE vaccines have been provided for the control of blood poisoning in sheep, epididymitis in rams, and leptospirosis in dairy cattle.

THE methods of rabbit poisoning have markedly improved.

LAST year, veterinarians were assisted in the diagnosis of over 14,000 cases of animal disease.

I will not attempt to assess the total annual value of these contributions to the farmers of New Zealand beyond suggesting that it greatly exceeds the £450,000 which we are now spending annually on animal research.



Continuing Problems

However, future expenditure should be based not on past achievements but on the anticipated returns from future work. Are there any unsolved problems whose solution would justify a continuation of the present rate of expenditure on animal research? That is a question which New Zealand farmers should surely seek to answer. Here are a few of the unsolved problems which are known to reduce the efficiency of animal production in New Zealand.

← Hogget ill thrift.

The low lambing percentage of Romney ewes.

Abortion in cows and ewes due to *Vibrio fetus* and in ewes due to *Toxoplasma*. These cannot at present be controlled.

The relatively low growth rate of fat lambs and beef cattle.

Milk fever, grass staggers, and rye-grass staggers.

← Tuberculosis and contagious abortion in dairy cattle and keds and lice on sheep, all of which could be eliminated.

Foot diseases of sheep and pigs.

Biting flies.

← The great losses which occur in hay and silage making.

In addition to problems which are at present recognised, it is likely that further study will result in the recognition of other factors affecting efficiency and it is certain that new problems will arise from further intensification of production. There seems little doubt that there will never be any lack of problems of great economic importance.

But is it likely that over the next 20 years animal research will solve enough of them to justify an expenditure of £450,000 per year?

I believe it is essential that farmers should study that question.

Efficiency of Production

During recent years, New Zealand farmers have become increasingly aware that they can do little to control the prices they receive for the produce they export. Their prosperity therefore depends on keeping down the cost of production and it is natural that they should be concerned at the cost of the things they have to buy, the level of wages they have to pay, and the cost of handling their produce outside the farm. It is, however, very doubtful if anything they can do will materially reduce these costs.

There is, however, one major factor in the cost of production which they can control. New Zealand farmers are probably the most efficient in the world and their efficiency is increasing. In his annual report for 1955 the Director-General of Agriculture presented a survey of 35 years' progress in New Zealand agriculture. He showed that during that time production per acre had increased by 160 per cent and production per unit of manpower by 180 per cent. He then said: "Thus we owe our ability to export an increasing volume of farm products to scientists, educationists, extension services, commercial interests, and, above all, to the remarkable capacity of the farming community to adapt goods and services to the advancement of our primary industries."

Conference Papers

OTHER Ruakura Farmers' Conference papers will in accordance with the usual practice be published in succeeding issues of the "Journal".

All the addresses and a resume of discussions on them will be included in the "Proceedings of the Ruakura Farmers' Conference Week", copies of which are supplied to those paying conference fees. Orders from those unable to attend the conference will be accepted up to time of going to press in a month or so. They may be sent with the cost of copies ordered (10s. per copy, post free) to the Publications Section, Department of Agriculture, Box 2298, Wellington, or the Ruakura Animal Research Station, Private Bag, Hamilton.

There is plenty of evidence that efficiency of production can still be increased. The question I want New Zealand farmers to answer is:

Can agricultural research make a worth while contribution to future increases in efficiency?

Farmer Encouragement

In 1953 I said: "What can the farmer do about research? He could, of course, do nothing. Even then research would go on because some of us believe that agricultural research is the most valuable service that we can render not only to the farmer but to New Zealand."

Since then research activities had been expanded, said Dr Filmer, and they had been well supported by the statutory boards, the Veterinary Services Council, and by many individual farmers. After discussing recent controversy about scientists' salaries, Dr Filmer continued:

The important question for New Zealand farmers to answer is not:

Are agricultural scientists adequately rewarded? but

Is agricultural research in New Zealand worth while to you?

If the answer is yes, you will be fighting your own battle if you do what you can to see that agricultural research continues in an effective way.

Calibre of Staff Important

In the past you have been somewhat critical of the administration of agricultural research. . . . but there is something infinitely more important than administration. Perhaps I can get my point across with three quotations:

The greatest of all research problems is the people who do the research.—"Punch" of 23 years ago.

The fact is that all really new developments of industry are the product of the work of very few men.—The late Sir Henry Tizard.

Let me therefore conclude by underlining the importance of good administration but by reminding you also that administration in science will not, of itself, produce a single new idea, and without new ideas science would cease to exist.—Sir Ben Lockspeiser, a former Secretary of the British D.S.I.R.

There you have it. Research is based on the original ideas of very few men. If these very few men can be encouraged to think and if arrangements can be made to test the ideas that arise from their thinking, you will get all that you can expect from research.

The law of averages makes it unlikely that New Zealand will produce many of the new ideas on which future progress will be based. But to obtain full value from the money spent on research we must have men who are quick to appreciate the potential value of new ideas, wherever and whenever they appear. And we must have men who have the enthusiasm, the ability, the training, and the tenacity required to test these new ideas and to evolve means of adapting them to the solution of local problems. The inability to attract and to retain an adequate number of these men is the major factor which limits agricultural research in New Zealand today.

Studying Disease at Wallaceville

DR LEON JACOBS, a world authority on toxoplasmosis, a parasitic disease of humans and animals, is studying the disease in sheep at the Department of Agriculture's Wallaceville Animal Research Station.

The study of toxoplasmosis is of considerable importance to New Zealand, as toxoplasma (a micro-organism) is the greatest individual cause of abortion in ewes and of losses in new-born lambs in this country. Wallaceville is doing research on the disease and the results are encouraging, but it is considered important that further extensive experimental work be done as soon as possible.

Dr Jacobs.

Dr Jacobs has been working on toxoplasmosis for at least ten years and is regarded as a world authority on the disease. His studies have covered a wide field and his knowledge and experience will be of very great value to the New Zealanders who are working with him.

Dr Jacobs is head of the Laboratory of Parasitic Diseases in the National Institutes of Health at Bethesda, Maryland. He has a Doctorate of Philosophy from George Washington University and has specialised in microbiology. During the war he was Malaria Control Officer for the United States Army in the South Atlantic theatre.

In 1955 Dr Jacobs received the Washington Academy of Sciences' Award for Scientific Achievement, the Barnett M. Cohen Award of the Maryland Branch of the Society of American Bacteriologists, and the Brooklyn College Alumnus Award. In 1954 he received the Arthur S. Flemming Award of the Washington Junior Chamber of Commerce as "one of ten outstanding young men in the Government Service".

Dr Jacobs was awarded a Fulbright Fellowship to enable him to study in New Zealand for eight months. His wife and three children have accompanied him.

Skin Damage in Bobby Calves

By A. A. JOHNSTON, Supervising Meat Inspector, Department of Agriculture, Timaru, and R. E. BURNELL, Livestock Instructor, Department of Agriculture, Whangarei

BOBBY calf skins and all other hides produced in New Zealand must be of top quality to compete successfully on world markets, and especially with the increasing development of alternative materials every care must be taken to avoid damage in production and marketing.

BOBBY calves are no longer the despised encumbrance of dairying in the early 1930s when the farmer got two or three shillings to save slaughtering the calves himself. How different today, when, with a minimum of time, labour, and expenditure, the once almost worthless "bobby" has become one of the most profitable animals on the farm.

In the last 25 years the bobby calf has become an important product of the dairy industry. While this is partly due to the high prices obtained overseas for our bobby veal, values of bobby calf skins affect considerably the payout to dairy farmers from bobby calf pools.

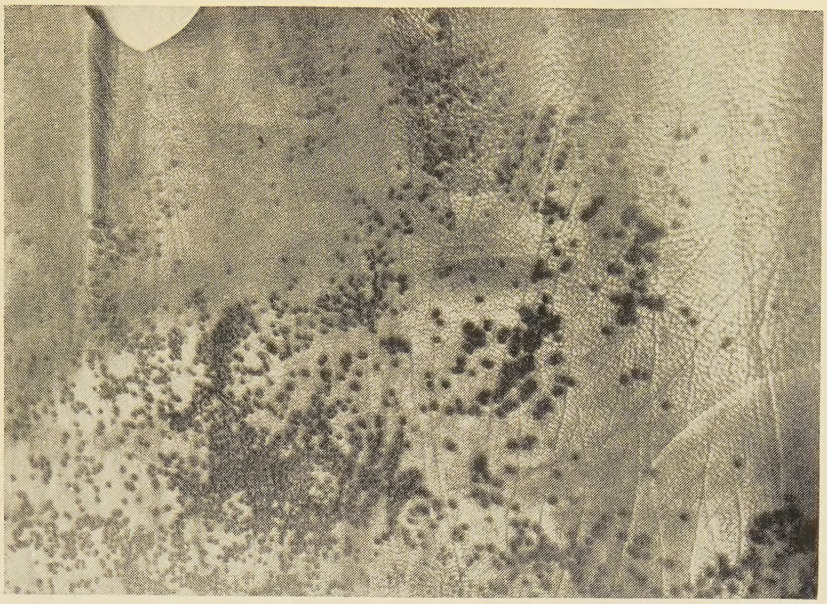
Markets

Calf skins are keenly sought by many countries, as is shown in the following table:

EXPORT SALES OF CALF SKINS IN 1958-59 SEASON

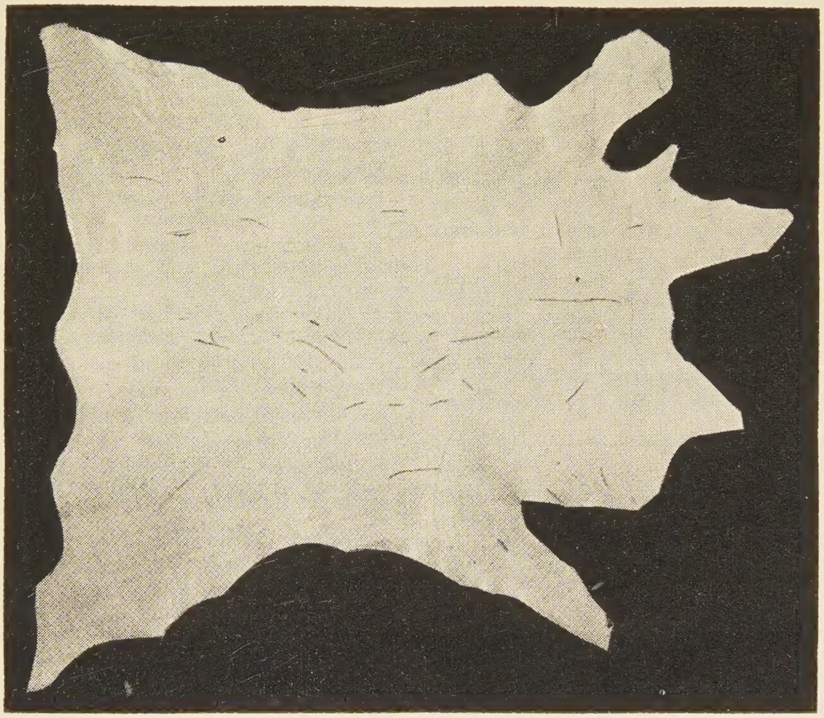
Holland	225,722
U.S.A.	195,965
Italy	193,844
Germany	138,711
United Kingdom	99,063
Belgium	44,540
France	18,696
Canada	10,000
Japan	2,400
Trinidad	1,000
Ireland	500
Portugal	200
Others	5,440
Total export	936,081

With sales within New Zealand of 183,800 the total number of skins sold was 1,119,881.



▲ Tick damage on a tanned skin.

▼ Skin damaged by cuts and scratches.



Such a demand makes the utmost effort to hold and safeguard these markets worth while. The buyer cannot be blamed if he is selective against an inferior article. If we are to retain this market, everyone who handles calves must do his best to ensure that a first-class article is offered.

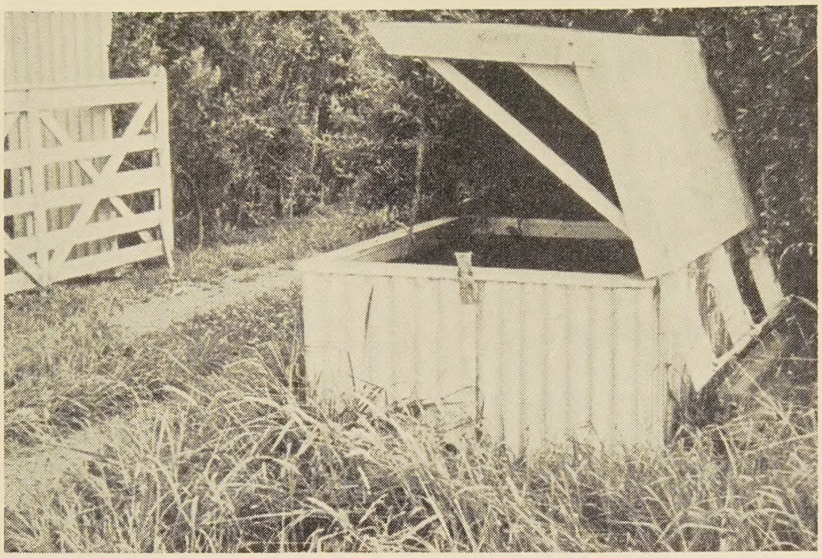
All the countries mentioned are keen buyers, but only of good skins. Too many skins are classified as second quality and under the pool system the return from good skins seems just to balance the loss from second-quality skins.

Uses

Young and fine-grained bobby calf skins are used substantially in the manufacture of women's shoes, the grain surface giving an excellent finish.

Depending on the trend of fashion, there can be a substantial increase from time to time in the use of suede

SKIN DAMAGE IN BOBBY CALVES



Roadside bobby calf pens should have no nails, bolts, or wire projecting to cause skin damage.

which is produced from the reverse side of the skin. Calf skins are exclusively used in the manufacture of suede jackets, which are most fashionable at present.

They are also widely used for making handbags of various types, of which the high finish required means that the skin must be blemish free, and this is something that cannot be determined until the skins have completed the tannery processes.

Calf-skin leather is also widely used in the manufacture of women's belts.

Defective or tick-damaged skins can be used only for shoe lining, and for this purpose calf-skin leather has to compete with cheap Indian goat or kip.

Values

After all processing charges bobby calf skins in the 1959 season were worth about £1 4s. a clean skin. If the payout to farmers for bobby calves is about £3, the skin is worth 40 per cent of this amount.

Loss from tick damage is 41d. per lb of skin and per calf would be 15s. 3d. or more than 60 per cent. The loss from tick damage alone by pools from Whangarei and Dargaville north totalled about £12,000 in the 1959 season, 14 per cent of the skins being down graded through this cause.

While the pool system has many advantages, it entails the disadvantage that the individual farmer does not know whether his calves are clear of ticks, as the loss is spread over the pool of both clean and damaged skins. The approximate loss is 2s. on every skin.

Damage

A bobby calf must be old enough and strong enough to stand the journey before being sent to the freezing works. At this age the skin of the calf is a comparatively soft tissue and very susceptible to damage.

Some common causes of damage are:

1. Scratches from barbed wire and scrub, such as blackberry.

2. Scratches and wounds from protruding bolts, nails, and wire in poorly constructed calf pens.

3. The marking of live calves with tar or other caustic substances.

4. Rough handling and overloading of calves in trucks.

5. The cattle tick *Haemaphysalis bispinosa*.

Skins from very immature calves are almost useless for tanning, as the leather is inferior and almost valueless.

Control of Cattle Tick

Cattle tick is not a serious pest in most parts of New Zealand, but it is fairly prevalent in some areas of the North Auckland peninsula, Bay of Plenty, and East Coast.

Cattle tick passes through three stages (larva, nymph, and adult), all of which cause damage to skins by biting.

Many farmers still leave their cows to calve on run-offs or in "warm" paddocks covered with scrub, rushes, and rank pasture, from which the new-born calf picks up the ticks, which find these conditions favourable in which to survive the weather and predators.

Few ticks, it is believed, actually pass from the cow to the calf and most of the ticks that damage bobby calf hides come from long, rank pasture. **A well grazed clean pasture could afford cover for only a light infestation of ticks.**

To overcome cattle tick infestation a hospital paddock, preferably close to the cowshed, should be cleared of all rank growth and topdressed with DDT or dieldrin to overcome tick infestation.

Dieldrin-superphosphate at 2 to 2½ cwt or DDT-superphosphate at 2½ to 3 cwt per acre, if carefully applied, could control cattle tick for at least two seasons provided tick-infested animals are not introduced to the area. The larger the area treated the slower will be the reinfestation from the surrounding fields. These insecticides have little residual effect in field conditions and consequently will kill only those ticks which come in contact with the insecticides before they are completely washed into the soil.

Topdressing with insecticides should be done during May, June, or July, when the nymph stage of the cattle tick is hibernating in the pastures. All stock should be removed from the paddock before treatment and kept off it until rain (at least ½ in.) has washed the DDT off the pasture. This is especially important if dieldrin is used.

Cows should be brought into this hospital padock one or two days before calving and only after being sprayed with a BHC or DDT, dieldrin, or delnav insecticide to prevent re-introduction of ticks.

After the calf is born it should be kept in the hospital paddock and thus the main hazards to skins of rank pastures, scrub, blackberry, or barbed wire will be avoided.

Other Causes of Damage

With proper care and handling of bobby calves by farmers, truck drivers, and works employees, other sources of damage can be avoided.

Recent experiments have shown that new-born calves running in a paddock with a few clumps of blackberry in it have received a considerable number of scratches which spoil the skin for tanning.

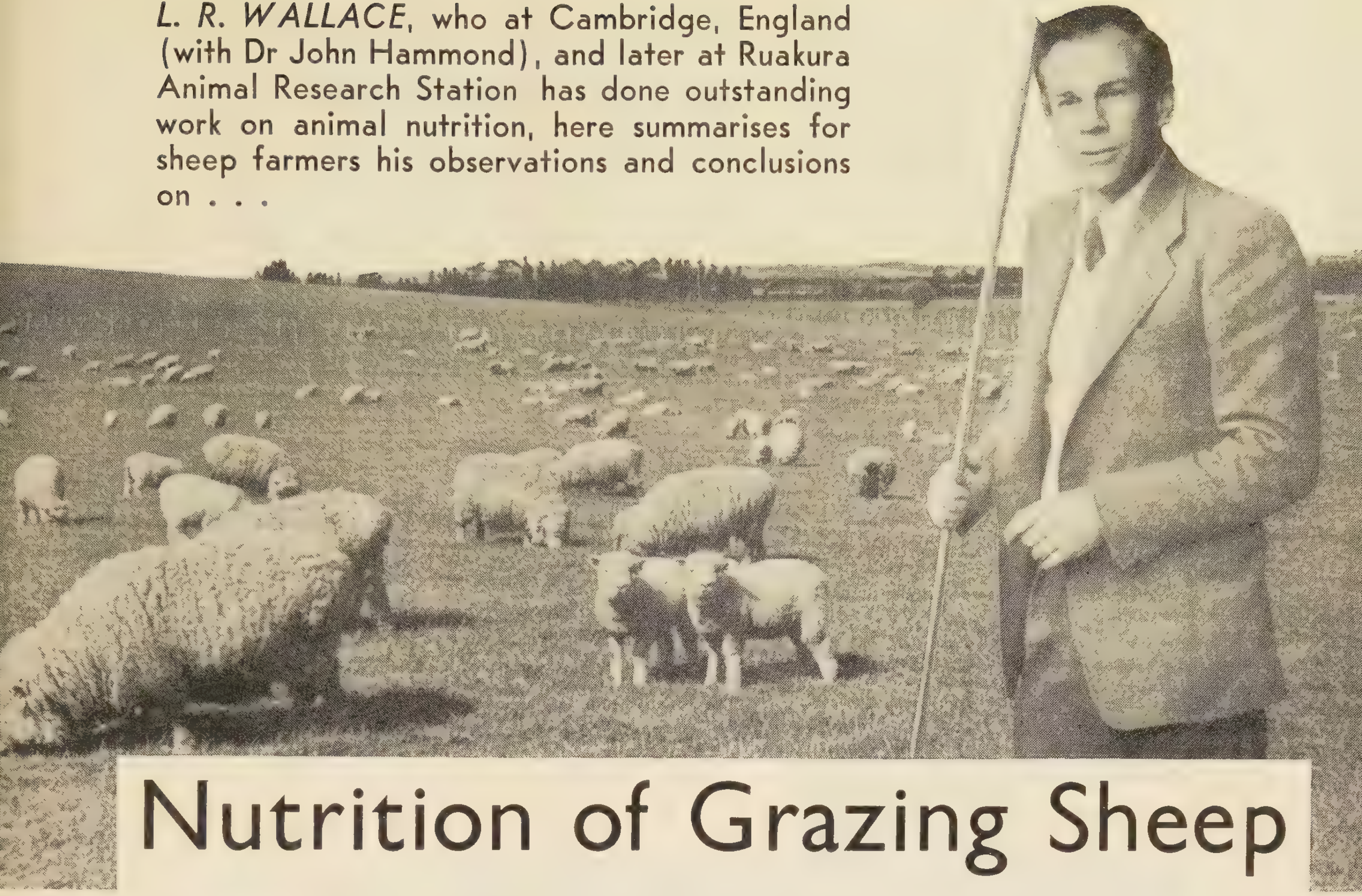
Marking calves with caustic substances and tars must be avoided; if calves have to be marked at all ordinary raddle or sheep marking fluids should be used. Paint does not harm the skin, but its use involves the risk of lead poisoning.

In roadside bobby calf pens there should be no wire, protruding bolts, or nails to cause damage or wounds.

Calf pool committees should recommend to their suppliers a suitable type or types of calf pen to which carriers should have easy access.

Bobby calf lorries or railway trucks should not be overloaded. Lack of partitions in crates and railway trucks may lead to damage.

L. R. WALLACE, who at Cambridge, England (with Dr John Hammond), and later at Ruakura Animal Research Station has done outstanding work on animal nutrition, here summarises for sheep farmers his observations and conclusions on . . .



Nutrition of Grazing Sheep

DURING recent years a lot of information has been accumulated which shows the way in which sheep respond to different levels of feeding for short periods at different times of the year. As a result we have a very clear idea of which are the more and which are the less important periods from the point of view of animal performance. Though there is still a very great need for long-term studies on a complete farm basis designed to ascertain the grazing management systems that will give the best overall results on different types of farms in different localities, the work already done has at least established the main principles on which grazing management must be based if good results are to be obtained.

SOME of the evidence relating to the nutrition of sheep at particular stages will now be briefly reviewed and some rather broader issues discussed.

For the breeding flock the year can be conveniently divided into three periods: from weaning until tupping, from tupping until lambing, and from lambing onward.

From Weaning Until Tupping

Most farmers are well acquainted with the practice of flushing and with the advantages which can be expected from it. Essentially it consists of feeding ewes so that they are definitely improving in condition for about three weeks before the rams are introduced and for the first three or four weeks of the mating period. The purpose of this is to stimulate the ovaries to ripen and shed an increased number of eggs at the time of mating and so improve the lambing percentage. The value of the practice has been thoroughly tested in numerous trials, some overseas and others in New Zealand, and we now know fairly well the sort of result that can be expected.

Flushing does not, as a rule, bring ewes on heat any earlier or reduce the percentage of ewes failing to lamb, and it may somewhat increase the lambing spread. Its most important effect is to increase substantially the proportion of twins born. If mature five- and six-year-old Romney ewes are properly flushed on pasture, about half of those that lamb should produce either twins or triplets, so that, allowing for a normal percentage of dry ewes and average ewe deaths and lamb losses, it is reasonable to expect to dock about 125 lambs from each 100 ewes put to the ram. This applies to well grown ewes run on typical fat lamb country.

Adapted from a paper presented to this year's Ruakura Farmers' Conference.

It is often emphasised that the ewes should be in vigorous store condition when flushing begins, as they then respond much better to an improved level of nutrition than do either very thin or overfat ewes. Indeed the opinion that overfatness tends to reduce fertility is widely held by farmers, and often ewes are deliberately grazed very hard for a period after weaning with a view to reducing their condition in preparation for tupping.

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'50' 50,000 units penicillin per tube.

'100' 100,000 units penicillin per tube.

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VETSPEN RATION Penicillin Feed Supplement.
For Increased Yields . . . Increased Profits. Gives young animals a good start in life.
Available in tins of 8 ozs., 2½ lbs., and 10 lbs.

VET-CREME
The antiseptic lubricant for assisted lambing. Stops cross-infection between man and animal. Avoids damage to delicate tissues. Heals cracked and sore teats.
Available in 4 oz. tubes and 16 oz. jars.

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Grass being converted directly to meat by weaned lambs, a much more profitable process than feeding it to them indirectly through the ewe in the form of milk.

There is, however, quite a body of evidence to indicate that high condition does not in itself reduce reproductive performance. A Romney flock of approximately 400 mixed-age ewes has been maintained at Ruakura for the last 10 years, and each year the ewes have been weighed about the middle of February, approximately a fortnight before the rams are turned in, and the way in which the lambing percentage has followed the live weight has been most interesting.

In the years when the ewes were heavy just before tupping, comparatively high lambing percentages have been obtained, while in seasons when the ewes were light, lambing percentages have been relatively low. These results suggest that it may be very poor practice indeed to overdo starving the condition off ewes after weaning.

A small trial was carried out at Ruakura in 1959 to obtain further information on this point. The lambs belonging to a flock of six-year-old ewes were weaned in mid December and the ewes immediately divided into three similar groups. During the next two months the ewes of Group 1 were grazed over the best pasture that could be provided, whereas Groups 2 and 3 were kept on poorer feed so that the animals steadily lost weight, one group being much more severely treated than the other. As a result by mid February the animals in Group 1 were exceedingly fat, whereas those in Group 2 were in moderate condition, and those in Group 3 rather thin.

From mid February on the ewes of all three groups were run together on the best feed that could be provided, and three weeks later, at the end of the first week of March, the rams were introduced. A sample of the ewes from each group was killed during the tupping period to determine the average number of eggs being produced and the balance of the animals was carried on and lambed together.

It turned out that the ewes which were allowed to become excessively fat before mating produced rather more eggs and had a higher lambing percentage than those from either of the other two groups. The number of dry ewes was greatest in the thinnest group and least in the fattest group, the ewes which failed to lamb being, in the main, animals which were rather thin at tupping.

It would probably be unwise to pay too much attention to the results from this one small experiment, and I should emphasise that in the trial just described the fat ewes were well fed from weaning right through to tupping. Results might have been very different if these animals had been allowed to become excessively fat by mid February and then been allowed to suffer a check during the critical six weeks starting three weeks before the introduction of the rams.

In the present state of knowledge it would seem wise to ensure that feed is conserved for flushing, even if this means having to do the ewes fairly hard after weaning.

There does not appear to be any good reason for grazing the ewes any harder than is necessary to ensure that sufficient feed is saved for the lambs and cattle and for flushing.

A prolonged period of semi-starvation after weaning can quite seriously reduce the fleece weight, for the rate of wool growth is affected not only during the period of poor feeding; when poorly fed animals in low condition are changed to a good diet they take time to recover. In the trial at Ruakura this year ewes that were fed so that they gained 10 lb live weight between mid December and mid February grew between mid December and mid March 0.7 lb more wool than did ewes which lost 10 lb during the same two months period, and over 1 lb more than ewes which lost 20 lb during the period of restricted feeding.

On the basis of the trials at Ruakura it appears that ewes should be flushed for at least three weeks before mating if optimum results are to be obtained. Naturally, it is important that the flock should be well fed throughout the period during which the ewes are being tupped in appreciable numbers, which usually means for three or four weeks after the rams are put out. The ewes in this trial at Ruakura were in good store condition at the beginning of flushing.

It is often stated that the beneficial effects of flushing do not appear to be related to the use of any particular feeds, and it is certainly true that good results have been achieved in many ways: by flushing on crops, by changing from poor to good pastures, and by feeding cereals. The main consideration is that the ewes should actually make substantial live weight gains and put on condition rapidly over the flushing period.

Nevertheless, it seems that under certain circumstances the nature of the feed can be of considerable importance. For instance, Professor I. Coop and co-workers at Canterbury Agricultural College, Lincoln, have recently reported the results of a two-year trial in which lucerne and grass were compared as flushing feeds. In the first year the ewes flushed on lucerne produced 10 per cent fewer twins and 15 per cent more barren ewes than those flushed on grass. In the second season 600 Border Leicester-Corriedale ewes were employed, half flushed on lucerne and half on ryegrass and white clover. Despite the fact that live weight changes were approximately the same in both groups, those flushed on lucerne produced 7 per cent fewer twins and 2 per cent more barren ewes, and their mean lambing date was delayed by five days. The reason for the comparatively poor results with lucerne is not at present known.

From Tupping Until Lambing

When a ewe is successfully mated the fertilised egg begins to develop during the three to four days which it spends travelling down the fine tube which leads from the ovary into the womb. Its size increases very little, if at all, during the first 10 days, and even

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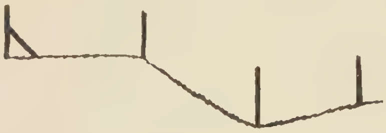

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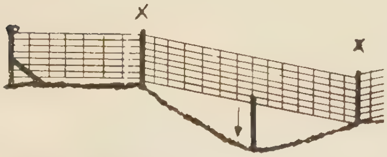

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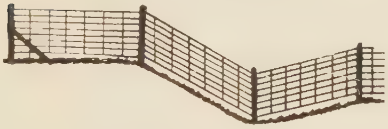

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at the end of the first month of pregnancy the embryo weighs only about 1/60 oz, being then about the size of a pea. At the end of the second month it weighs about 2 oz and at the end of the third between 1 and 2 lb. By the end of the fourth month the fetus is usually still not quite half grown and weighs between 4 and 5 lb. The rate of weight increase is thus at a maximum during the final month before birth, and it is therefore not surprising that this is the critical period in the nutrition of the ewe.

The feeding of ewes during pregnancy can be conveniently discussed under the following heads: the effects on birth weight, on ewe and lamb mortality, on the rate of growth of the lambs after birth, and on the wool grown.

Feeding trials carried out by the author at Cambridge in England with Dr J. Hammond after the war showed that the level of nutrition of the ewe during the first three months of pregnancy had little effect on the growth of the developing lamb, whereas very poor feeding later had a most pronounced effect on birth weight. The relative unimportance of feeding in early pregnancy has also been shown by feeding trials conducted in Scotland in which raising the level of feeding of ewes during the last month was as effective as a high level of feeding throughout pregnancy in producing lambs of good birth weight.

The extent to which the birth weight of lambs is affected depends, of course, on the degree of under-nutrition imposed in late pregnancy, and it is much more difficult to affect the birth weight of single lambs than of twins. Results from a grazing trial that was repeated over three successive years at Ruakura illustrate this very well.

Each year a group of Romney ewes was mated to Southdown rams and the animals run together as a single flock up until five weeks before the first lambs were due to be born. The flock was then divided into three groups. The first group was grazed on abundant pasture and the ewes gained on average about 5 lb a week. The second group was fed on a somewhat lower plane; they gained about 2½ lb a week. The third group was grazed very hard indeed and did not gain weight, but actually lost condition. The lambs were weighed within 24 hours of birth, and the ewes and lambs from the three groups were all run together from the time of lambing onward. The average birth weights of the lambs are shown in Table 1.

TABLE 1—EFFECT OF LEVEL OF FEEDING OF EWES BEFORE LAMBING ON BIRTH WEIGHT OF LAMBS

Birth weights (average)	Level of feeding High lb	 Medium lb	 Low lb
Singles	10.3	10.2	9.6
Twins	8.8	8.4	7.3

On average the single lambs from the medium-plane ewes were almost as heavy as those from the high-plane ewes. The low-plane treatment did, however, reduce the birth weight of the single lambs by about 0.7 lb. The effect on birth weight of the twins was graded according to the level of feeding, with an average difference of approximately 1½ lb between the extreme high- and low-plane treatments.

At first sight it might be argued that at least as far as the singles are concerned the average differences in birth weight are so small as to be of no practical importance. However, average values can be very misleading. The small average difference of 1/10 lb shown between the birth weights of the single lambs from the high- and medium-plane ewes was, in fact, almost entirely due to quite a large effect on the biggest lambs, particularly on the biggest of the ram lambs. The 10 per cent heaviest ram lambs from the high-plane ewes were on average 1 lb heavier than the corresponding ram lambs from the medium-plane ewes; and with big single lambs weighing about 13 lb an extra pound can make all the difference between a relatively easy birth and an extremely difficult one.

Ewe and lamb mortality, at lambing itself and during the first week after birth, is probably the greatest single source of economic loss in sheep in New Zealand, and the birth weight of the lambs governs the magnitude of this loss considerably.

Among single lambs losses tend to be concentrated among the very heavy lambs. For instance, when the single lambs born over the three years in the grazing experiment just described were grouped into birth weight classes and the mortality within each birth weight class ascertained, it was found that the death rate at birth and during the first week was only 3.3 per cent for lambs of about average size weighing 9 to 11 lb, but over 30 per cent for the heaviest lambs weighing 13 lb or more and for the lightest weighing 7 lb or less.

Birth weight is also very important with twins, losses being concentrated among the lighter twin sets. Over the three years at Ruakura the death rate among twin lambs at birth and during the first week was only 7.3 per cent for those weighing more than 7 lb, but 28 per cent among those weighing 7 lb or less.

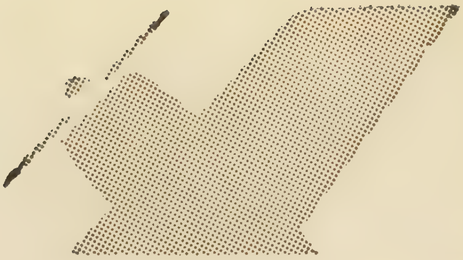
From the foregoing it will be clear that to minimise lamb mortality a very high level of feeding before lambing should be avoided, for it is apt to result in a proportion of very big single lambs which the ewes have difficulty in delivering, and among which a high death rate must in consequence be expected.

On the other hand, a very low level of nutrition must also be avoided, for this will result in an unduly high proportion of light weight twins, which tend to be born weak and which are apt to die through failure to get a drink, from exposure, or from mis-mothering during the first few days after birth.

During each of the three years at Ruakura lamb losses were lowest among the lambs from the ewes which had been fed only moderately well during the pre-lambing period. Though this intermedate level of feeding reduced the birth weight of single lambs by an average of only 1/10 lb, it was effective in reducing the proportion of single lambs weighing more than 11 lb from 13 per cent to 5 per cent.

Effect of Level of Feeding during Pregnancy on Growth of Lambs After Birth

A lot of information on this is available from experiments in which ewes differently fed before lambing



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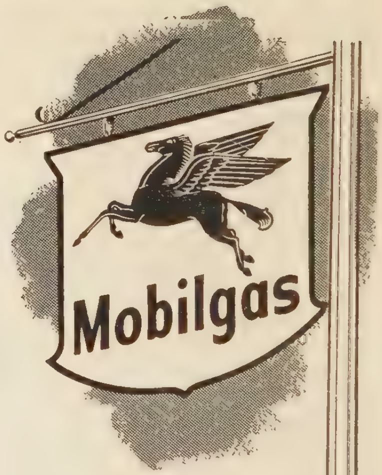

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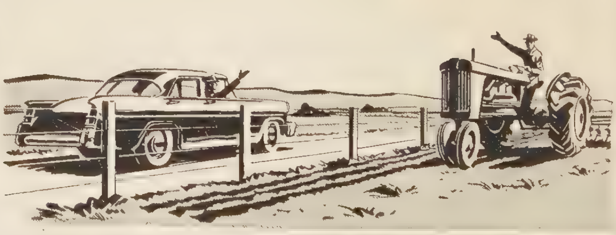

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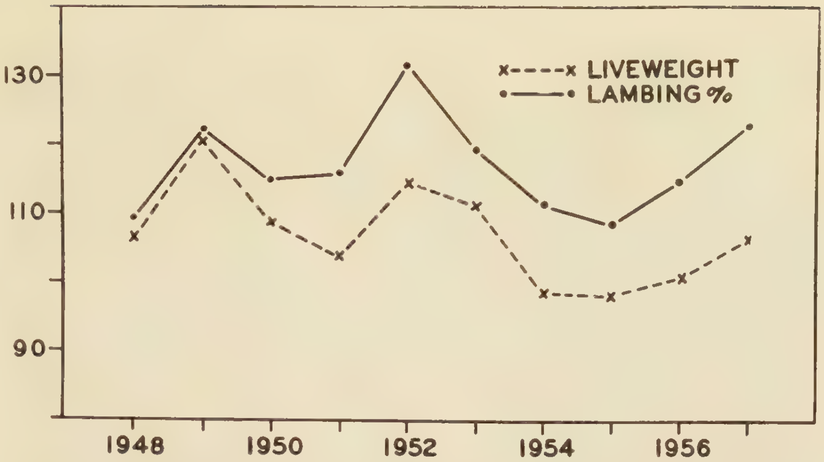


Average liveweight and average lambing percentage of ewes from Ruakura trial data, showing the way the lambing percentage follows the liveweight pattern. In years when the ewes were heavy just before tupping comparatively high lambing percentages were obtained; in seasons when the ewes were light lambing percentages were relatively low.

have been grazed together from lambing onward.

In the Ruakura studies already referred to the lambs from the three groups of ewes all grew equally well. At Canterbury Agricultural College, Lincoln, Professor I. Coop also has found that a high level of nutrition during pregnancy, which increased birth weight by about 0.5 lb, had little if any influence on the rate of growth and the weaning weight of the lambs, irrespective of the level of nutrition after lambing.

In attempting to explain this, Professor Coop has suggested that provided the level of feeding before lambing is not too low, the ewes poorly fed are still reasonably strong and vigorous at lambing, and after lambing are hungry and probably eat more than ewes that have fed at a high level previously, which tends to stimulate milk production.

Whatever the true explanation, I think it can be taken as established that differences in plane of nutrition before lambing which produce only small differences in birth weight usually have little or no effect on the subsequent growth rate of either single or twin lambs.

Wool growth is, of course, affected by the level of feeding during pregnancy. In the trials carried out at Ruakura over three seasons the average fleece weight of the ewes that were moderately well fed before lambing was only about 1/10 lb less than that for the high-plane ewes, but the very low level of feeding reduced fleece weights by an average of 0.6 lb. In the trials carried out by Professor Coop at Lincoln, 14 weeks of differential feeding before lambing produced differences in fleece weight which averaged about 1¼ lb.

Pregnancy toxaemia disease, usually associated with a sudden check in nutrition near lambing, can cause very heavy losses. It occurs mainly in ewes with single lambs. It is uncommon in ewes that are well fed or on a slightly rising plane of nutrition over the last few weeks of pregnancy, but ewes carrying twins and fat as a result of good feeding in early pregnancy are certainly not immune. Indeed many people hold the view that such fat animals are the most susceptible to a sudden food shortage before lambing.

Bearing trouble can be extremely troublesome during the last few weeks before lambing, and this complaint can no doubt be seriously aggravated by liberal grazing on lush pastures before and during lambing.

From Lambing Onward

A lot of experimental evidence emphasises the importance of level of feeding after lambing. In studies at Ruakura where ewes have been treated alike up to lambing, but thereafter stocked at different rates on similar pastures, the more heavily stocked animals have produced the lighter lambs at weaning. At Lincoln Professor Coop has produced live weight differences at weaning amounting to about 10 lb for singles and 10 to 15 lb for twins simply by varying the level of feeding after lambing.

During the first month or six weeks of its life the lamb is almost entirely dependent for its growth on its mother's milk, and each additional 4 lb of milk that a lamb drinks during the first month of its life will increase its live weight when a month old by about 1 lb.

From six weeks of age onward, however, the lamb becomes increasingly dependent on the pasture it eats, so that grazing management must be directed to having really high-quality feed available from this time onward. Usually by the end of the third month of lactation milk production has fallen to quite a low level, and if feed is becoming short, there is much to be said for early weaning, particularly under hill country conditions where the objective is not the production of fat lambs and where a large number will have to be carried through the summer drought period.

On fat lamb farms it is probably unwise to consider weaning until the first draft is taken. If feed is abundant, the lambs remaining after the first are sent away will probably do better if left with their mother for a further period; but if feed is short, they should be weaned so that the ewes do not compete for the available feed and the best can be offered to the lambs.

At the Ruakura Hill Country Station E. A. Clarke has found that the greatest advantage of early weaning lies in the flexibility that it confers on stock management. There, ewes which were shorn and whose lambs were weaned in late November have been used most effectively to control bracken fern still in the vulnerable early frond stage, and this method of fern control has proved cheaper and more effective than any other method of grazing management with other classes of stock.

So far I have been concerned mainly with the manner in which sheep respond to different levels of nutrition imposed over particular periods and with the general levels of nutrition that must be provided if the best results are to be obtained from the individual animals. However, few sheepmen are in the happy position of being able to farm just for the interest and pleasure of doing so. Most are obliged to pay close attention to financial returns. Thus in discussing the nutrition of sheep at pasture one is really concerned not so much with those methods of feeding and management that are best for the animals, but rather with those that are likely to prove most profitable to the men who own them.

The sheep farmer's income is derived in part from the sale of wool and in part from the sale of stock. His returns are determined not merely by the average productivity of his animals, but also, and very greatly, by the total numbers of these that his farm can be made to carry. A high rate of stocking is indeed probably the most important factor of all in achieving a high output of meat and wool per acre, and there is little doubt that it is usually well worth while to make some sacrifice in the level of production per animal to obtain a really high carrying capacity.

It is usually much more important

to ensure that the stocking rate is sufficiently high to utilise completely all the feed grown than it is to strive for maximum production per animal.

At Ruakura Miss D. E. Walker has shown this to be true for fat lamb production, while Mr Clarke and his colleagues have shown it to be the case on breeding country at the Ruakura Hill Country Station. There, trials are being carried out to compare the production obtained from a flock well managed throughout the year and always fully fed with that from a similarly bred flock farmed under a system of heavy stocking at all times.

Results to date show that the heavy stocking system has reduced wool production per ewe by about 15 per cent, the lambing percentage by up to 10 per cent, and the weight of the lambs at weaning by about 10 to 12 per cent. The information obtained does not yet permit accurate conversion of these differences to a per acre basis, but Mr Clarke's carefully considered estimate of the relative stocking rates under the two systems is about three for the heavily stocked animals to two for the others, and there is no doubt that the heavily stocked system would yield the greater return on a farm basis.

In New Zealand, pasture forms virtually the sole diet of sheep, and the only control that the farmer can exercise over the nutrition of his flock at different times is through grazing management. Pasture does not grow uniformly throughout the year, and the real essence of a successful pasture management programme is the adoption of a system that over a period of years will result in an overall improvement in pasture productivity and at the same time ensure that the essential feed requirements of the animals are adequately met, particularly during critical periods.

The critical periods for the breeding flock are fairly well defined. They are in late summer and early autumn just before and during tupping, in late winter during the last stages of pregnancy, and in early spring shortly after lambing. For the lambs, the whole of the lactation period and indeed the first nine months of life are, in fact, a critical time, but after the onset of the spring flush the problem is seldom that of a feed shortage, but rather one of maintaining herbage quality.

The importance of a high stocking rate has already been stressed, and under a farming system aimed at the fullest possible utilisation of all feed grown the method of feed utilisation is clearly most important. This is particularly true of the periods of low pasture production.

Though, as far as I am aware, no critical experiments have been carried out to test the practice, there would seem to be a very good case for the spelling of a proportion of the farm in late April and May when the rate of pasture growth is still reasonably high and when the ewes can be grazed reasonably hard without disadvantage, so that a reserve of feed is built up for use during the poor pasture production period in late winter and early spring when animal needs are considerably higher.

The most effective method of utilisation of this saved feed can be a difficult problem. It can be rationed off very economically by an on-and-off system of grazing, but pastures that have been allowed to grow too long tend to deteriorate in quality and after grazing may be rather open and low in clover content.

In my view the autumn-spelled pastures should not be allowed to grow too long and should, in the main, be grazed off by ewes before lambing or by those with young lambs at foot. As soon as the earliest born lambs get to the stage where they begin to eat pasture in any quantity they are best transferred to and lightly stocked on the paddocks that are just freshening after having been kept under close grazing through autumn and early winter.

At this stage the later-lambing ewes and those with young lambs can be concentrated to clean out the autumn-saved paddocks thoroughly, which if grazed in this way should, as spring advances, freshen nicely to provide feed of good quality by the time this is required by the later-born lambs.

In my experience the quality of the feed present on autumn-saved paddocks that have been partially grazed off is quite suitable for unlambed or freshly lambed ewes, but is not good enough for lambs a month or six weeks old.

On many farms it is usual to rotationally graze through autumn and winter and to set stock from lambing onward. Unless serious damage from trampling and pugging occurs, rotational grazing through winter has much to commend it. Stock can be compelled to utilise fully all feed present on areas that may have been previously neglected or differentially grazed under set stocking. Such differential grazing is, of course, particularly prone to occur on paddocks of broken contour.

The rotational grazing system, too, is one that even during a period of feed shortage inevitably results in the accumulation ahead of the flock of a reserve of feed, and the size of this reserve can be regulated by the speed of rotation. Moreover, as lambing approaches, it is an advantage not to have to search the whole farm each day for ewes that are cast or in trouble in other ways.

Just before and also during a period of feed abundance it is sound practice to set stock, particularly if the contour is such that surplus feed cannot be conserved in the form of hay or silage. During flush periods the problem seldom is one of feed shortage, but of maintaining feed quality and of delaying as long as possible the stage when feed quality deteriorates through the uncontrolled growth and premature seeding of pastures. This is more easily achieved under set stocking. When entering a period of abundance a reserve of feed ahead of the flock is merely an embarrassment. Also there seems no good reason why the animals should not be given full opportunity to exercise what preferences they may have in herbage selection.

Most of the trials that have been carried out to contrast the effects of the set stocking and rotational grazing systems after lambing have shown rather better lamb growth under set stocking. At Ruakura under intensive fat lambing conditions L. J. Lambourne compared set stocking and rotational grazing at three different levels of stocking—four, six, and eight ewes per acre. At the lower rates the rotational system resulted in rather poorer lamb growth, but at the higher rate it was definitely superior. In no case was there any substantial difference in ewe wool production or live weight gain.

The only long-term grazing management study that has been carried out in New Zealand is that conducted by F. E. T. Suckling at the Te Awa hill research area. There he compared the set stocking and rotational grazing systems on a complete annual basis over a number of seasons. Set stocking gave much superior production in terms of meat and wool. Mr Suckling found that the rotationally grazed ewes became so accustomed to shifts that they were in a constant state of unrest and ready to move at the slightest disturbance. As a result over the lambing period mismothering was a constant worry, ewes being apt to desert a newly born lamb, a weaker twin, or a sleeping lamb.

There is great need for further long-term investigations to compare the production that can be obtained from various systems of grazing management, particularly to contrast results from systems of feed utilisation specifically designed to ensure that the known requirements of the flock at critical stages are adequately met with those from uncontrolled systems such as set stocking which have given surprisingly good results on many occasions.

Many of the trials that have been reported can be criticised on the grounds that they have been concerned with comparing various routine methods of stock movement rather than with grazing management systems intelligently aimed at fitting the variable supply of nutrients from pasture to the variable but known nutritional needs of animals.

Newly Developed Scrub Land Needs Heavy Topdressing

By G. J. BATTEN,
Farm Advisory Officer,
Department of Agriculture,
Thames

MANY virgin soils being developed from scrub and fern in the Auckland Province lack especially nitrogen and available phosphate. Pastures will not grow satisfactorily on soils deficient in these elements.

NITROGEN build up will be rapid under stocking on a vigorous clover pasture. Nitrogen return from dung and urine and trampled in plant residues may be equivalent to about 1½ tons of sulphate of ammonia in a year. However, pasture will not establish and grow vigorously unless the phosphate and any other soil deficiencies are corrected.

Soil test figures for available phosphate on some of these soils are very low and 9 cwt of superphosphate is needed in the first year. Originally this was applied in three dressings of 3 cwt: at sowing; after four to five months; and again the next autumn. The pasture grew well if the second application was on time, but too often it was delayed to six to seven months after sowing and the clover received a severe check.

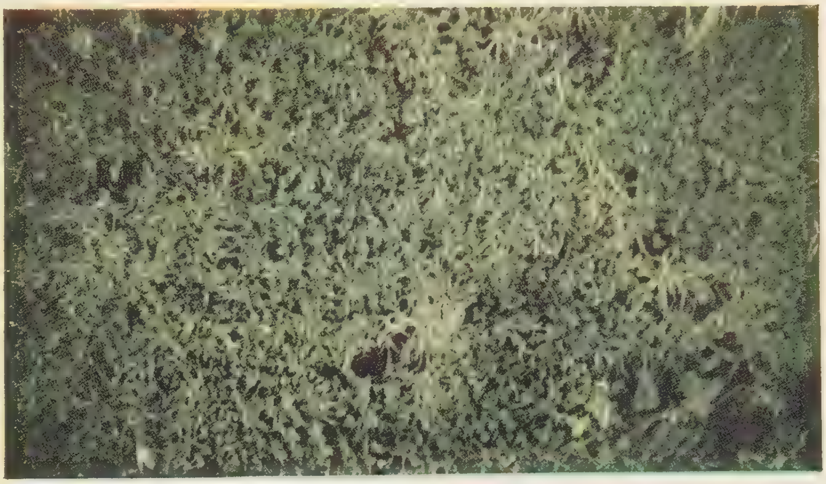
A. V. Allo, Tauranga, reported in the March 1957 "Journal" that where growth continues for most of the year a heavier rate of phosphate initially is desirable rather than spread over several dressings, and that with a heavier rate of phosphate the seeding rate could be reduced. Farmers have been quick to adopt a lower seeding rate, but some have been loath to increase topdressing rates correspondingly, leading to unthrifty, weedy pastures, some of which need resowing.

If 9 cwt of superphosphate is needed in the first year, 6 cwt should be sown with the seed and the balance in the following spring to autumn.

The high costs of land development have encouraged the cheaper method of crushing and burning the existing vegetation, oversowing, topdressing, fencing, and stocking. This method also has the advantage of not disturbing the consolidation that is so vital in seedbeds on light soils. However, it does result in a lot of regrowth weeds such as fern, manuka, and tauhinu, which need judicious mob stocking to control. A good pasture is necessary to compete with these weeds and to withstand heavy stocking.

Provided cultivation and sowing are correct, heavy initial topdressing will ensure good pasture establishment on these soils.

By summer the autumn-sown pasture above, which was topdressed with 3 cwt of superphosphate at sowing and again in November, was unthrifty and clover deficient; the pasture below, which was sown with 6 cwt of superphosphate, was thriving.



A vigorous clover pasture is necessary for rapid nitrogen build up so that the pasture will compete with regrowth of fern and other weeds.

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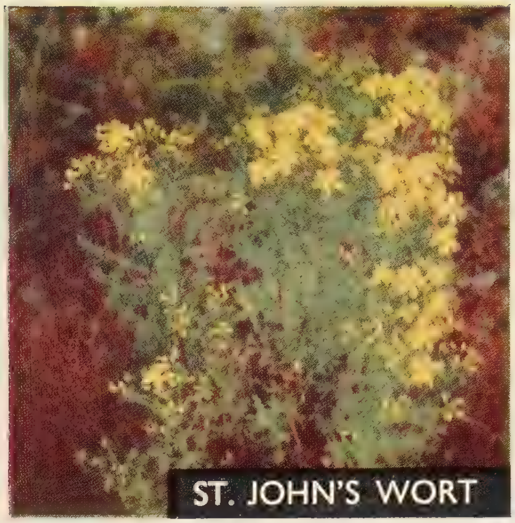
WEED IDENTIFICATION AND CONTROL

This is one of a series of articles illustrated in colour to appear in the "Journal" from time to time in which identification and control of various weeds will be discussed.


ST. JOHN'S WORT

By L. J. MATTHEWS,

Principal Scientific Officer, Department of Agriculture, Wellington

ST. JOHN'S wort (*Hypericum perforatum*) is the type name of the family *Hypericaceae*. Tutsan also belongs to this family as do many ornamental species.

ST. JOHN'S wort spreads by underground rhizomes and seeds. The stems are erect, two-edged, and branching and carry masses of yellow flowers. Plants, which vary in height from 1 to 3 ft, are easily recognised by the opposite entire (not toothed) leaves which if held up to the light show a number of small transparent dots and by the numerous stamens being united into bundles. There are no stipules. The three spreading styles are between the bundles of stamens. The anthers do not touch the stigma, so that cross and self pollination depend on insect visitors. Numerous dark brown seeds are set.

Why is it a Weed?

St. John's wort is widespread in New Zealand in waste areas, particularly on hill country in some parts of the South Island. Eating of the weed by sheep, cattle, or horses causes them to become photosensitive—the light-coloured patches of unpigmented skin of affected animals become sensitive to sunlight. The severe irritation which develops causes the animal to rub, scratch, or bite the affected parts.

Sheep, because they graze more closely than cattle or horses, are more prone to eat the leaves and stems of young shoots when these are just coming through the ground. Both leaves and stems cause photosensitivity.

St. John's wort beetles vigorously attack St. John's wort plants for about two months before mating and egg laying take place. The beetles appear in early summer and may be seen throughout autumn.

Control

St. John's wort will not compete with a productive sward; it is mainly a weed of waste areas and open ground. It is included in the first schedule of the Noxious Weeds Act, but as it is a weed of waste areas and open ground, it cannot be regarded as seriously as a weed that competes with productive pastures. It is a weed that is declining, probably owing to increased improvement of areas now infested by it.

Two methods of control are available to supplement its control by farm management.

Biological Control

The St. John's wort beetle, *Chrysolina gemellata*, has successfully controlled the weed in the United States, and the same or a similar beetle (*C. hyperici*) has proved of value in New Zealand and Australia. Control by biological methods is not adequate unless followed by pasture improvement to preclude re-establishment of the weed. Though the St. John's wort beetle declines as its host plant diminishes, eradication is never complete, because the St. John's wort builds up more quickly than does the beetle.

Use of Weedkiller

St. John's wort in waste areas can be controlled by the emulsifiable esters of 2,4-D at rates of up to 2 lb of acid equivalent per acre applied at the flowering stage. If spraying is not followed by practices aimed at increasing pasture production, more than one application is required to kill the plants completely. In waste areas the regrowths should be treated at maximum leaf development.

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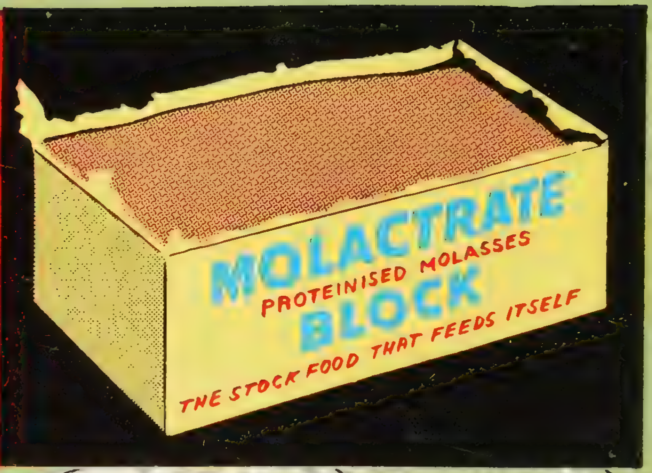
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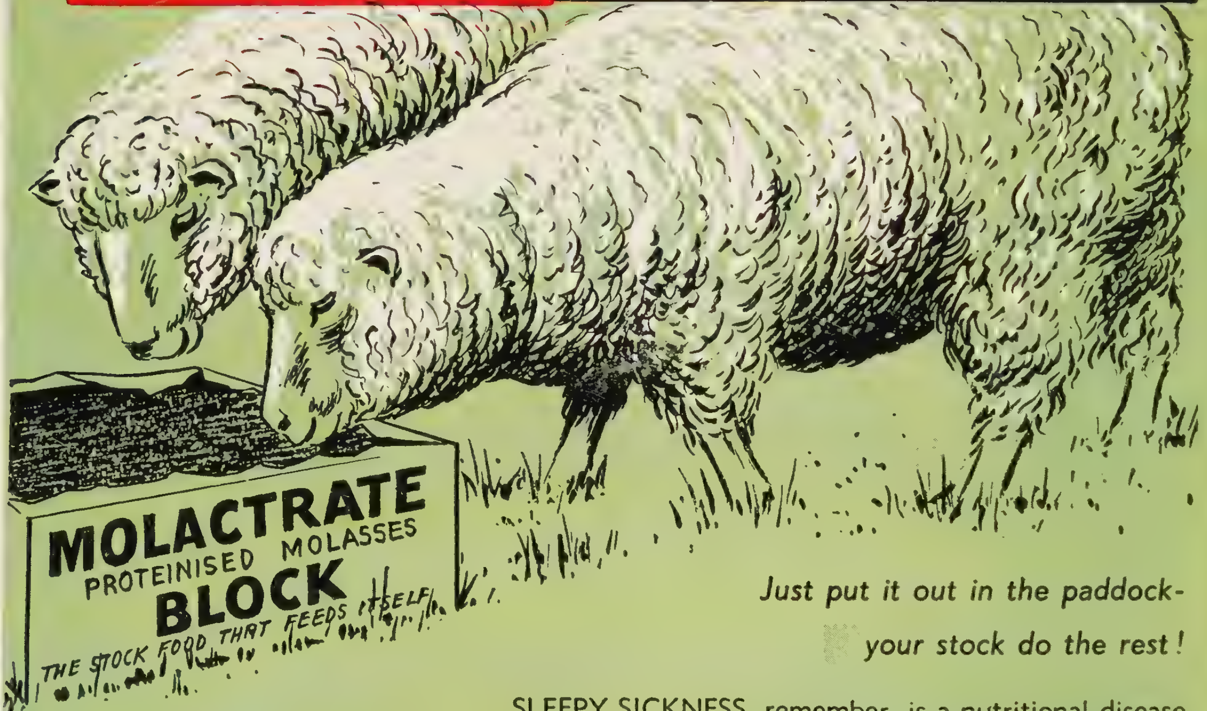
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The stock food that feeds itself

Production of Winter Green Feed Cereals and Renovation of Dairy Pastures in Canterbury by Autumn Overdrilling

By D. J. G. DAVIES,
Fields Instructor,
Department of Agriculture,
Christchurch

OVERDRILLING of pastures as a means of cereal green feed production without resort to the plough has been under trial on a number of town milk supply farms cooperating within the Department's farm improvement scheme. This article describes the recommended methods where overdrilling of pastures with cereals and/or grasses is contemplated.

Arawa wheat overdrilled into good pasture.

THE provision of winter and early spring green feed is an important aspect of livestock husbandry under most farming systems, especially where whole milk production during winter is involved. This feed is conventionally provided by autumn-saved grass and/or the growing of green feed cereals, brassicas, or root crops on cultivated areas.

A system of combining the use of nitrogenous fertilisers directly with sod-seeded cereals was investigated at the McGarvie Smith Animal Husbandry Farm, Badgery's Creek, New South Wales, Australia, as early as 1956 with the primary concern of providing out-of-season green feed for dairy farms engaged in the production of whole milk for the Sydney metropolitan area. The liberal use of nitrogenous fertilisers, a winter growing cereal, and, when occasion demanded, of sprinkler irrigation was stated to be essential to success.

Objectives

The main objectives are:

1. Provision of out-of-season green feed during autumn, winter, and spring, when both feed requirements and milk payments are at a premium.
2. More efficient utilisation of herbage grown as wastage is reduced through consolidated ground conditions.
3. Subsequent renovation of grass-deficient pastures by introduction of new grass.
4. The development of an effective means of reducing pasture renewal costs.
5. Stimulation of pasture production by the balanced use of nitrogenous and phosphatic fertilisers.

Secondary objectives include:

1. A possible reduction of the bloat problem in the spring through the suppression of clover growth by introduced cereals and grasses.
2. The provision of a heavy summer hay crop after winter grazing.
3. Suppression of weeds.
4. The provision of more palatable and nutritive herbage.
5. More efficient management of pastures for winter feeding.

When visiting Australia in 1958 the writer was so impressed with the possibilities of this method for application on clover - dominant, high - fertility dairy farm pastures in New Zealand that local investigations were begun in Canterbury that year. These and subsequent field trials have confirmed earlier impressions and demonstrated the suitability of the method for town milk supply dairy farms.

Local trial work began and still

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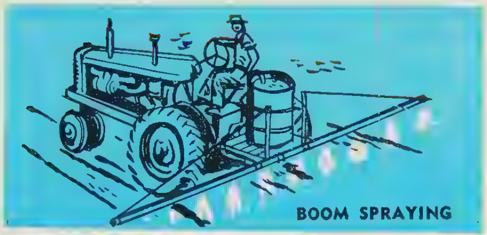
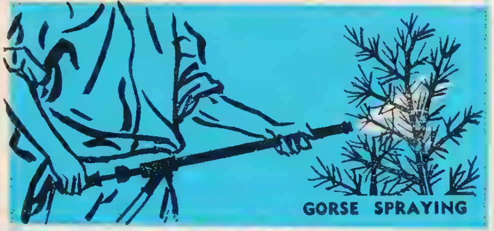
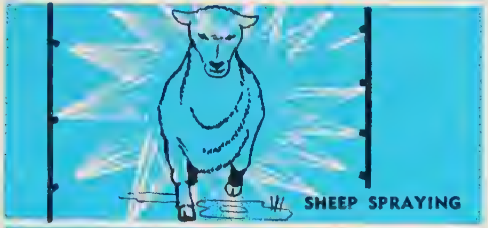
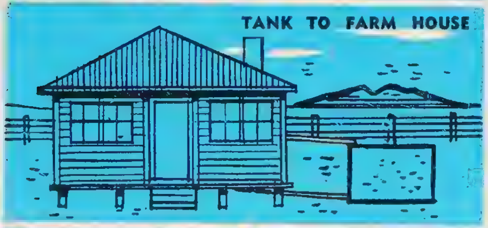
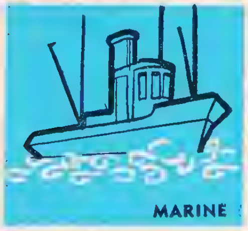
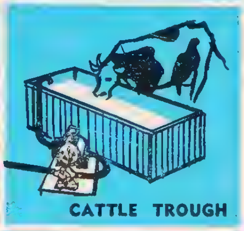

BOOM SPRAYING


GORSE SPRAYING


SHEEP SPRAYING


TANK TO FARM HOUSE


MARINE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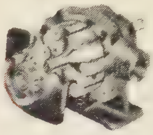
N6000.
Nylon roller pump operates at pressures up to 200 lbs. P.S.I. High and low pressures for gorse or pasture spraying. Operates from power take off or independent petrol engine.

N1500.
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continues on the property of Mr R. P. McCarthy, Tai Tapu, Canterbury, where for many years autumn-sown green feed had been grown by conventional methods to supplement autumn-saved pasture. Unfortunately, complete utilisation of this feed was often not possible because wet ground resulted in high wastage through excessive trampling by stock. Hand cutting and carting of the green material had often to be restorted to.

The idea of growing green feed without cultivation naturally had much to commend it to this farmer, who had already established to his own satisfaction that cereals would grow without cultivation. A further stimulus for this work was provided by the severe drought of 1957-58 when an enterprising sheep farmer in the Amberley district successfully overdrilled with cereals two-thirds of his 250-acre farm.

Since no prior ground preparation is involved, overdrilling can be conveniently undertaken as soon as adequate moisture is available, and the method has wide application as an emergency measure after drought and the depredations of insects and various farm pests.

Suitable Cereal Varieties

On the basis of trials to date the following varieties can be recommended as suitable for overdrilling according to recommendations:

C.R.D. Ryecorn

C.R.D. ryecorn, Crop Research Division, D.S.I.R., selection has proved to be among the most productive of our winter cereals.

It has the capacity to remain winter green and is highly resistant to frosts, but because of its prostrate growth it tends to lodge. Therefore grazing should be carried out at frequent intervals until spring.

Best results are obtained by grazing when growth is at 4 to 6 in.

C.R.D. ryecorn will withstand severe trampling by stock, is most resistant to cereal yellow dwarf virus, and should be grown in preference to other varieties where this disease is severe.

Wong Barley

Wong barley has given consistently good results in trials on the more fertile soils of Canterbury and has for some years been grown to a limited extent in the Marlborough district. It is a good winter and spring producer and like ryecorn recovers well after grazing. Its erect growth enables it to compete vigorously with grass, but, once established, is likely to become dominant in the sward. Under continuous grazing it is subject to a dormant period during mid winter. Wong barley is susceptible to both rust and cereal yellow dwarf virus.

RUSSET OATS
WINTER GREY OATS

Russet oats (left) and Winter Grey oats disc drilled in autumn for winter sheep feed and photographed in May.

Arawa Wheat

Arawa wheat, one of the two new high-yielding varieties bred and recently released by Crop Research Division, D.S.I.R., Lincoln, is a most promising green feed for high-fertility conditions and compares most favourably with Dreadnought, which it was developed to replace. It gives best results when sown at a higher seeding rate than other cereals. However, it does not appear to withstand vigorous grass competition and is susceptible to cereal yellow dwarf virus.

Cape Barley

Cape barley is a most useful producer of a large bulk of late-autumn and early-winter green feed and is one of our oldest and more reliable feed barleys. It is essentially a producer of a large bulk of green material for a short period and cannot be relied on to produce through until the spring. Cape barley is also susceptible to rust and cereal yellow dwarf virus infections.

Winter Grey Oats

Winter Grey oats have given consistently good results in field trials and are most suitable for low-fertility soils. Like most oat varieties the recovery growth is only fair, and the variety is susceptible to cereal yellow dwarf virus.

Onward or Russet Oats

Onward or Russet oats are the best cereals to grow, particularly where a fast-maturing bulk of feed is required. With their erect growth there is less tendency to lodge than with other varieties. Little recovery growth can be expected and both are susceptible to cereal yellow dwarf virus and rust.

A number of other cereal varieties are being tested for overdrilling and greenfeed, but those mentioned have been satisfactory when used as recommended.

Pasture Renovation

The inclusion of from ½ to 1 bushel of Italian or short-rotation ryegrass seed per acre with the cereal at sowing is strongly recommended, as it will substantially improve the grass/clover ratio and general quality of pasture by spring.

Trials have shown that little winter production can be expected from any grass sown with cereals in autumn, but that such grass is well established by the end of winter. As the cereal production declines the grass contribution of the sward improves. This provides additional spring and summer grazing, and the combination of cereal and grass may be shut up for an above-average yield of hay if desired.

A hay crop on Mr McCarthy's farm yielded 3.6 tons per acre after being shut up at the beginning of October. Early haying is desirable, especially where irrigation equipment is available to stimulate further growth of pasture for summer grazing.

Experience has shown that the weed problem on overdrilled pastures compared with that on cultivated pastures is negligible and if it does occur, it can be effectively controlled by winter grazing. The light-suppressing effect of a dense bulk of cereal also hinders weed development and ultimately aids eradication.

Seeding and Fertiliser Rates

While further experimental work still remains to be done on optimum

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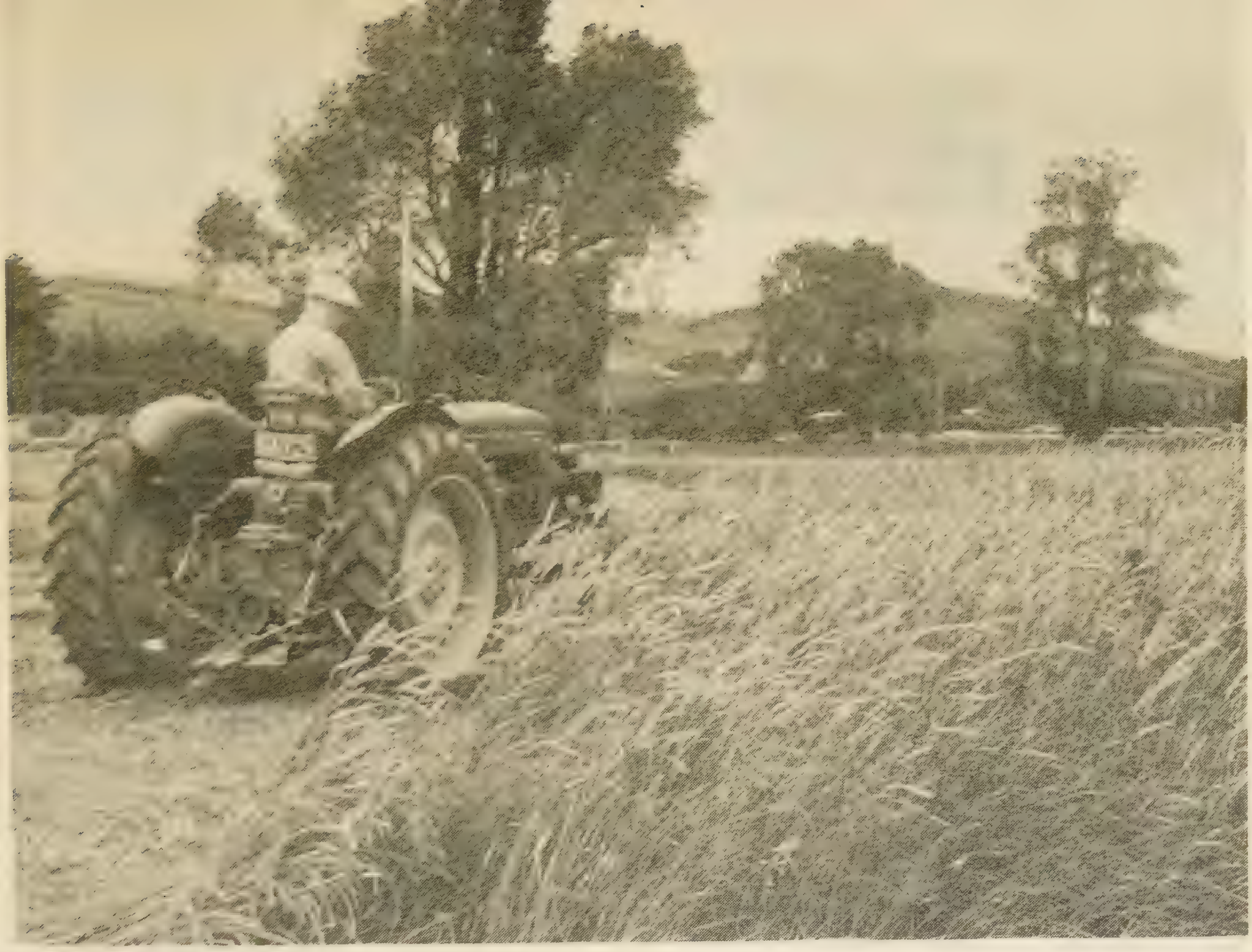

rates of fertiliser and seed usage of cereal, sufficient is known to indicate that comparatively low seeding rates will give satisfactory results. However, the evidence also suggests that higher rates will give correspondingly higher production initially.

Where early maturing cereal feed is required seeding levels of up to 4 bushels and not less than 2 bushels per acre will give satisfactory results. In general, the lower the fertility is the more seed will be required, and, conversely, where fertility is higher lower rates may be used safely.

The above remarks apply only to closely grazed, bare, open swards and if cereal seeding is attempted under any other pasture condition, seeding rates should be stepped up accordingly to combat vigorous grass competition. The most satisfactory results to date have been achieved on basically clover-dominant swards where another cereal/grass crop is superimposed on established legumes.

Fertiliser

Because of variability in fertility from farm to farm and even paddock to paddock the exact quantities of fertiliser to use must be determined largely by the farmer's knowledge of the productive qualities of the pastures to be treated. However, in general, the lower the level of fertility the more nitrogenous and phosphatic fertilisers must be used.

The following minimum rates are recommended as a guide and are based on the results of trials on a variety of dairy farm pastures in which the nitrogenous fertiliser used was of the ammonium nitrate-lime mixture type:

1. High fertility: 1 cwt of nitrogenous fertiliser and 1 cwt of superphosphate per acre.
2. Medium fertility: 2 cwt of nitrogenous fertiliser and 1 cwt of superphosphate per acre.
3. Low fertility: 3 cwt of nitrogenous fertiliser and 2 cwt of superphosphate per acre.

The liberal use of nitrogenous fertilisers during February and March will ensure the maximum production of green, succulent leafage for winter feeding and will markedly improve pasture vigour by spring. High rates of nitrogen should not be drilled with seed if the soil is dry, as injury to young seedlings is likely to occur.

As nitrogenous fertilisers will cause corrosion if they are in contact with metals too long, the manure box should be thoroughly cleaned out as soon as drilling is completed.

The use of fertiliser when overdrilling obviates the need for autumn topdressing the treated pastures. Where it is intended to concentrate on winter green feed production in the same paddock each year, adequate rates of fertiliser, particularly nitrogen, should be used. This will allow the introduced crop to get away to a good start with a minimum of interference from established plants.

The use of potash is recommended in addition to nitrogen and phosphate in those districts known to be deficient in potash.

▲ Heavy crop of hay being cut on the property of Mr R. P. McCarthy, Tai Tapu. (Note C.R.D. ryecorn in full ear.)

Sowing Time

Overdrilling may begin any time after mid January, but late February-early March is normally the best time, provided soil conditions are suitable. It is essential to delay drilling until there is a reasonable supply of soil moisture to ensure adequate and even penetration of the drill points or discs and to facilitate quick, uniform germination of seed.

If overdrilling of several small paddocks is contemplated during February and March, sowings at fortnightly intervals are recommended to provide continuous feeding.

Drilling Equipment

For relatively even and level ground on dairy and sheep farms both ordinary coulter and disc types of drills have been found suitable.

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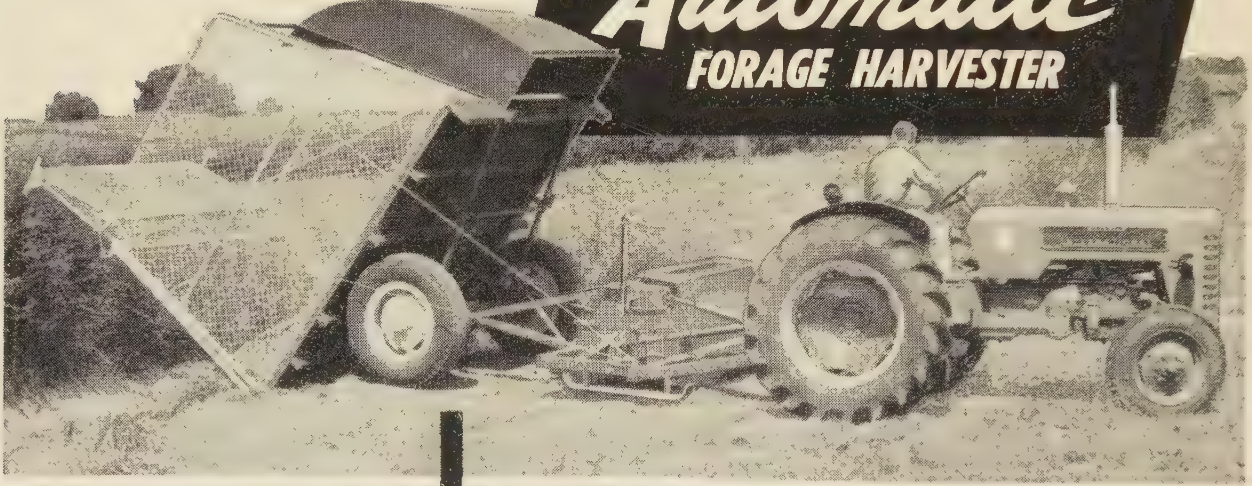

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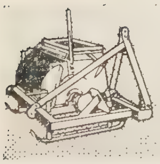

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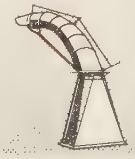

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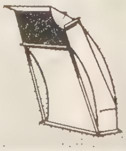
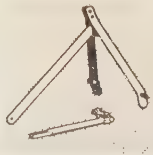


Fixed Chute



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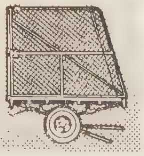

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Disc Drills

With the revolving cutting section of disc drills, penetration is easily achieved, except on hard, dry soils, which should not be drilled unless sprinkler irrigation is carried out either before or immediately after drilling.

Hardened, steel-pointed groovers will assist the following discs to cut into the loosened soil and ensure uniform spread and coverage of the seed. They also prevent imprisonment of the seed under the cut furrow lip, which is a common fault of discs, especially in heavy soils. Where suitable grooving attachments are not available, the angle of tilt may be increased in some types of drills to cut a more open groove, thereby lessening the risk of smothering germinating seeds. Disc drills are also ideal for overdrilling stubble paddocks provided threshed straw has been baled or evenly spread after heading.

Conventional Rigid Coulter Drills

Some excellent results have been obtained with conventional rigid coulter drills fitted with sharpened steel points and/or special grassland tips and used under ideal soil moisture conditions. Pastures must be bare and clean of all trash at drilling; otherwise frequent blocking will occur. Concentrated pre-grazing with stock or close trimming of paddocks with a flail-type forage harvester will assist in the preparation of the pasture for overdrilling.

A certain amount of spring tension is necessary on each coulter to aid penetration and coverage of the seed. Individual coulters should be weighted on drills where spring tension is not possible. However, such modification to conventional drills is only makeshift and these machines should not be used for drilling large areas unless they are specially strengthened. If these precautions are not taken, twisting of coulters out of alignment and/or bending of the drawbar frame is likely to occur.

Recommendations

1. If grass grub or porina is present or suspected, DDT-superphosphate should be broadcast at 1 cwt per acre.
2. All cereals should be treated with one of the approved mercurial seed dusts to aid germination, establishment, and control of fungous diseases.
3. Use of sprinkler irrigation equipment will not only ensure ease of drilling and a good strike, but continued use will hasten development of a high yielding green feed crop.
4. Overdrilling without the aid of a nitrogenous fertiliser is uneconomic.
5. The following cereal varieties will give the best results for feeding to dairy cows.

   Long-term production: C.R.D. ryecorn, Wong barley, and Arawa wheat.

   Short-term production: Cape barley, Winter Grey oats, Russet oats, and Onward oats.
6. Always include from ½ to 1 bushel of Italian or short-rotation ryegrass at sowing.

Standard Sod Seeders

Various types of sod seeders are available commercially for overdrilling and are particularly suited for rough, uneven flats and hill country.

▼ Cereal green feed (Onward oats) being break fed in May; sown with a disc drill at 4 bushels per acre in a pasture normally considered too wet for winter grazing after cultivation.

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Such drills are ruggedly constructed for work under adverse conditions. Most makes differ from ordinary drills in that maximum penetration is obtained by a combination of spring tension and screw pressure, the latter similar to that used on spring-type cultivators.

As these machines were originally developed for sowing grasses and clovers, they are not entirely suitable for seeding cereals, because, without a grain box, seed must be sown mixed with fertiliser through the manure box. This results in erratic sowing of grain with a consequent irregular strike. They are also inclined to leave the soil in a semi-grubbed condition, allowing birds easy access to the cereal. No doubt, with modifications, these limitations could be overcome.

Whether follow-up chain harrowing or rolling is carried out or not is largely determined by circumstances after drilling and obviously is warranted only if seed is not completely covered by soil or if the surface is left very rough. Chain harrowing is especially necessary after overdrilling into semi-moist to dry soil. Rolling will be beneficial in reducing a cloddy soil to a loose crumb structure.

Management of Treated Pastures

As the prime purpose of introducing cereals and grass into established pastures is two-fold, namely, the supply of valuable winter fodder and a renovated pasture by spring, the following management points should be strictly adhered to:

1. Do not allow established grasses and clovers to smother young cereal and grass seedlings. Graze lightly and often during first month after treatment. This aspect is particularly important where swards are dense, as such grazing treatment will suppress competition and result in the development of a strong root system and maximum absorption of light.

2. Once satisfactory establishment of cereals is achieved pasture may be shut up for first feeding. With declining soil temperatures grass and clover growth is not quite so rapid at this stage and cereal growth already accentuated by readily available nitrogen should dominate by the time of the first feeding, usually within six to eight weeks from sowing.

3. Strip grazing or break feeding with an electric fence will ensure a minimum of wastage.

4. To ensure a maximum bulk of green feed for the critical winter months of June and July early grazing should be lenient during March-April. The more feed is taken then, the less will be available when it is most needed.

5. It is recommended that several paddocks be treated in a similar manner, at fortnightly intervals during February and March, to obtain an extended feeding period. Judicious grazing management should make possible a continuous supply of green feed throughout winter, with a consequent saving of valuable hay.

▲ The groover point is fitted in front of the cutting disc to facilitate penetration and coverage of cereal grains.

6. Cereals like C.R.D. ryecorn and Wong barley will recover for further feeding during August and September and grass will also be making a useful contribution of green feed at this period. After this final cereal feeding, which should coincide with the availability of alternative feeding, farmers would be wise to consider a further application of a nitrogenous fertiliser of up to 2 cwt per acre as an added stimulus to young grass growth that will lead to an above-average hay or grass seed crop.

7. If alternative grazing is clover dominant, grazing of overdrilled pasture should continue until bloat danger is past.

Conclusions

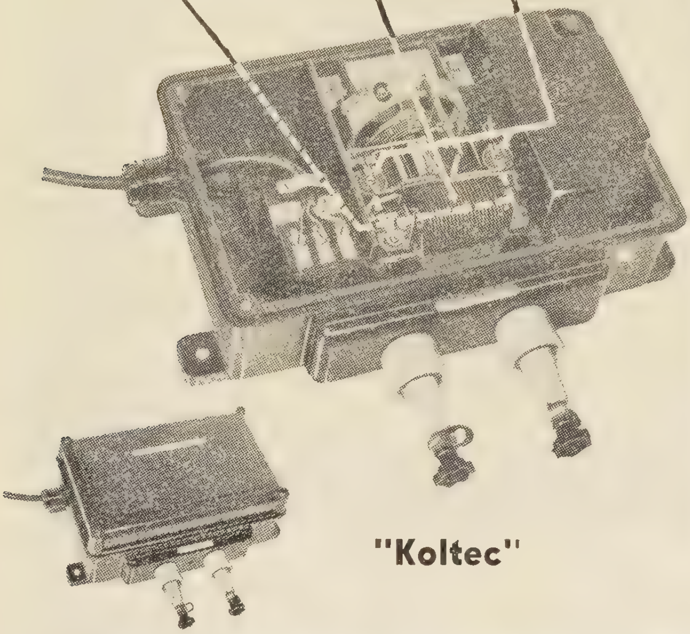
Possibly the chief advantage of this practice is the minimum time lag between sowing and utilisation; there is no lengthy period of cultivation to cause loss of production from a pasture.

In addition, particularly in a dry season, good soaking rains can be immediately capitalised on to obtain a certain "strike" of seeds. An attractive aspect and one of most importance to farmers is the ease with which feed can be fed off directly to stock without trampling or fouling of pasture even in very wet weather. Yields of green fodder are comparable to those achieved by cultivation and therefore it is considered to be a more palatable and balanced ration for stock. In trials, recovery of pasture growth by spring has been remarkably quick.

Depending on the fertility of the area, the cost of manures, seeds, and cultivation ranges from £4 to £9 per acre.

Much work remains to be done on the economic implications of this system for both dairy and sheep farms, but for town milk supply farmers the economic advantages are clear. Other avenues remain to be explored, particularly the prospects of combining the method with chemical ploughing, the use of which has already been justified under certain conditions.

There is no doubt that the equivalent production of feed and the attainment of a pasture performance which normally takes two seasons by conventional means can be achieved in a single season with one simple farm operation; and a more flexible pattern of pasture management, more adaptable to climatic vagaries, is introduced.



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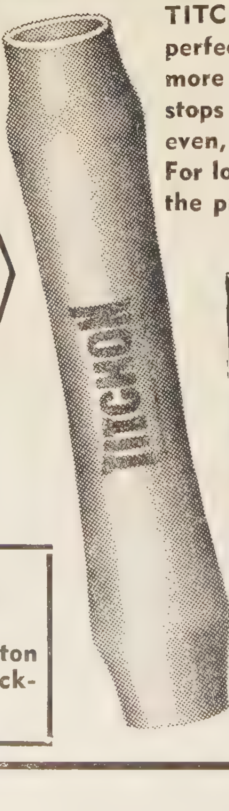

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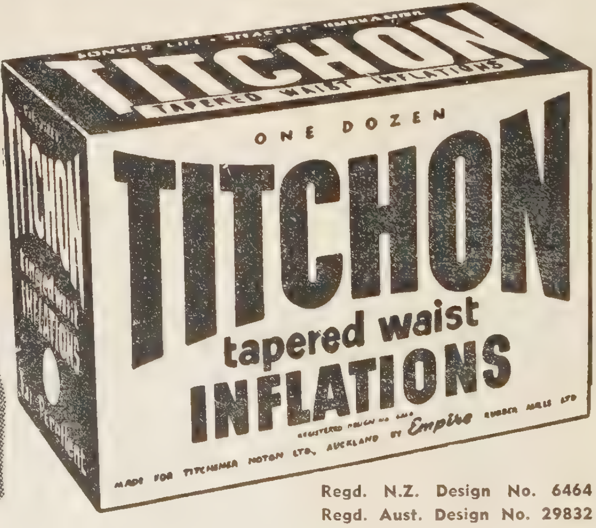

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Calves Profitably Reared on Buttermilk on Taranaki Sheep Farm

By
A. R. MURDOCH, Livestock Instructor, Stratford,
and
H. G. TURNBULL, Farm Advisory Officer (Economics), Palmerston North,
both of the Department of Agriculture

REARING dairy calves for sale can be a profitable sideline for sheep farmers as well as for dairy farmers. Feeding buttermilk powder makes it possible and the methods used and the results achieved by a Central Taranaki sheep farmer who successfully reared 39 calves without a cow on the property prove that it is quite practical.

THE use of buttermilk powder for calf rearing has increased considerably in Taranaki over the past three years. This is due to the advent of the milk tanker (which collects the whole milk from the farm, leaving no skim milk for calf rearing) and a better knowledge of the use of the powder.

The results of successful trials at the Stratford Demonstration Farm have been widely publicised in Taranaki and have aroused interest among some sheep farmers as well as dairy farmers.

The Demonstration Farm uses a multiple feeding system. A 20-gallon milk can holds the milk. About half way up the can are 15 holes evenly spaced round it through which plastic tubes with teats for sucking are passed. This allows for any number of calves up to 15 to be fed at once.

This method has proved successful when used with commonsense and the calves reared in this way have shown more bloom on their coats than bucket-fed calves. With this system it is possible for a fast drinker to get more than its share, but this should be prevented by allowing the smaller or slower drinking calves to start first.

Farmer's Experience

One sheep farmer who became interested was Mr P. B. McKenzie, Kota Road, Toko, Central Taranaki, who runs 750 ewes and replacements on his 236-acre property of improved hill country. In the past he has been buying in eight-months-old calves and selling them as springing heifers at three years. In their second year they are used to clean up paddocks after sheep.

This season Mr McKenzie purchased 41 calves from farmers with high-producing herds. The calves were two days to a week old.

System of Feeding Buttermilk

The feeding system used by Mr McKenzie differed slightly from the Stratford Demonstration Farm method.

Part of the back of Mr McKenzie's farm. It is typical of thousands of acres of Taranaki hill country.

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CALVES PROFITABLY REARED ON BUTTERMILK ON TARANAKI SHEEP FARM

Mr McKenzie shifting the calves into a fresh paddock. Rotational grazing is the key to trouble-free rearing. In the background is Mt Egmont.

A wooden rail was attached to the front of an old set of calf bails. Holes were bored in the rail for plastic tubes, from each of which a calf sucked up milk from its own bucket. All the calves could be fed at once and the arrangement ensured that each got the correct amount of milk.

The first 30 calves had been fed on whole milk for a week, but the last 11 were fed with it for only two or three days. The whole-milk feeding was done by arrangement on the farms where the calves were born. This was a wise move, as it is desirable for calves to be fed on whole milk for at least a week and longer if possible before they are changed to buttermilk powder.

The calves were fed twice daily with 3½ pints each time of a mixture of 2 lb of buttermilk powder to 1 gallon of water. This is equivalent to whole milk in feeding value. A fortified vitamin oil was fed regularly, care being taken not to exceed the recommended dosage. An antibiotic supplement was added to help prevent scours. Mr McKenzie used the vitamin oil and the antibiotic supplement because he thought they would be helpful and make the job easier for him.

These extras are expensive and could be done without, as has been shown in trials at the Stratford Demonstration Farm.

Hygiene was closely watched because of its bearing on the occurrence of scours. Mr McKenzie was very careful to keep all equipment and the feeding areas as clean as possible to keep down the incidence of disease.

Twenty calves were fed dry buttermilk powder when they were six weeks old. One pound of powder per calf per feed was put in a communal trough. This proved both successful and time saving, especially at shearing time.

Contagious Abortion Can Cause Permanent Sterility

PROTECTION of heifers against contagious abortion is sound business, as many in-calf heifers that slip at five months never come in milk at all.

In addition to the loss of milk from heifers with the disease, inflammation of the womb left after the abortion is a potent cause of permanent sterility.

Dairy farmers cannot afford not to have their calves vaccinated.

Early inquiry should be made of Department of Agriculture officers or club veterinarians to ensure inclusion in the heavy programme of vaccinations starting in January and February.

Good hay was available to the calves before and after weaning. One bag of calf pellets was fed to several calves that were not thriving as well as the rest.

Vaccinations

The calves were vaccinated against leptospirosis at one month of age and against blackleg at three months of age. Vaccination against contagious abortion was to be done at eight months. No drenching has been necessary.

The calves were kept in a large paddock and weaned when 10 weeks old. Rotational grazing was carried out after weaning and the calves were moved about the farm as much as possible and this certainly improved their growth rate. There were two deaths, one calf being killed in an accident and the other dying at an early age from an unknown cause.

Costs and Returns

A record of costs has been kept and those to date are set out below:

41 calves @ £3 each ..				123	0	0
Food:						
Buttermilk powder ..	118	15	9			
Antibiotic supplement	12	10	0			
Fortified vitamin oil	3	3	9			
1 bag of calf pellets	2	0	0			
				136	9	6
Vaccinations						
Leptospirosis @ 7s. 6d. each	15	7	6			
Blackleg @ 2s. each	4	2	0			
				19	9	6
				278	19	0
Cost per calf for 39 = £7 3s. (approx.)						
Value (March): 39 heifers @ £15 ..				585	0	0
Profit				306	1	0
Profit per calf = £7 17s. (approx.)						

(Continued on page 35)

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SHELL Weedkiller "B"—2,4,5-T Ester (LV)
For the control of gorse, blackberry, briar, broom and other woody weeds. Contains 3.6 lb. acid equivalent 2,4,5-T per gallon.

SHELL Weedkiller "D"—2,4-D Amine
For the control of rushes and many pasture and cereal weeds. Contains 4 lb. acid equivalent 2,4-D per gallon.

SHELL Weedkiller "E"—2,4-D Ester (LV)
For control of thistles, ragwort, flat weeds and "difficult" weeds in pastures. Contains 3.6 lb. acid equivalent 2,4-D per gallon.

SHELL Weedkiller "L"—2,4-DB Sodium
For selective control of docks, thistles, nettles, fathen, etc., in lucerne, clover and grassland. Contains 2.5 lb. acid equivalent 2,4-DB per gallon.

SHELL Weedkiller "M"—MCPA Potassium
For the control of thistles, docks, etc., in cereals and pastures. Contains 4 lb. acid equivalent MCPA per gallon.

SHELL Weedkiller "P"—MCPB Sodium
For control of weeds in peas, undersown cereals and pastures. Contains 3 lb. acid equivalent MCPB per gallon.

SHELL Weedkiller "Q"—PCP
For the selective control of weeds in a variety of arable and vegetable crops and bulbs during the pre-emergence stage. For defoliation and control of blight. Contains pentachlorophenol (PCP) in a selected grade of petroleum oil.

SHELL Weedkiller "W"—Petroleum Distillate
For the selective control of weeds in carrots and as a pre-emergence spray on certain other crops.

Aldrex* 2
An emulsifiable concentrate for the control of soil insects in crops. Specially designed for low-volume spraying. Contains 2 lb. of aldrin per gallon.

Dieldrex* 15
An emulsifiable concentrate for the control of chewing insects. Specially designed for low-volume spraying. Contains 1½ lb. dieldrin per gallon.

Aldrex* 40% W.P.
A wettable powder primarily designed for use as a soil insecticide, as a broadcast treatment or mixed with fertiliser. Contains 40% aldrin.

Dieldrex* 50% W.P.
A wettable powder for use as a foliage spray. Contains 50% dieldrin.

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Meteorological Records, April-May

APRIL

Station	Height of station above M.S.L. (ft)	Air temperatures in degrees (Fahrenheit)				Rainfall in inches					Bright sunshine hours
		Approx. mean	Difference from normal	Absolute maximum and minimum		Total fall	No. of days of rain	Difference from normal	Maximum fall		
				Maximum	Minimum				Amount	Date	
Kerikeri	240	60.0	— 1.1	77.0	44.0	3.23	14	— 2.37	1.42	10	150
Auckland	160	60.6	— 0.7	72.2	47.6	4.86	11	+ 0.47	1.89	17	200
Tauranga	12	58.4	— 0.1	73.9	39.2	1.27	5	— 3.75	0.88	17	205
Ruakura	131	56.0	— 0.6	71.3	32.0	0.79	9	— 2.95	0.19	17	190
Whakarewarewa ..	1,006	55.0	+ 0.0	71.9	35.5	0.97	9	— 3.84	0.50	17	188
Gisborne	14	57.5	— 0.4	80.9	41.3	7.80	19	+ 4.14	3.68	12	127
New Plymouth ..	160	58.1	+ 0.0	68.8	43.6	0.90	6	— 3.88	0.30	5	188
Karioi	2,125	50.4	+ 0.0	67.0	30.0	1.09	10	— 2.73	0.34	13	
Napier	5	57.4	— 1.1	79.3	40.6	3.16	13	— 0.53	1.64	12	130
Wanganui	72	55.9	— 1.6	71.8	38.2	0.98	8	— 1.82	0.45	30	194
Palmerston North ..	110	55.8	— 0.8	69.0	38.0	0.95	12	— 2.41	0.31	30	149
Waingawa	340	53.7	— 0.8	74.3	36.0	0.86	13	— 2.04	0.17	30	124
Wellington	415	55.7	— 0.6	68.0	45.3	0.63	9	— 3.18	0.14	1, 11	164
Nelson airfield ..	5	53.4	— 0.7	74.6	34.3	0.22	3	— 2.73	0.13	5	207
Blenheim	12	55.2	— 0.3	79.2	36.1	0.23	7	— 1.81	0.08	5	181
Hokitika	15	53.0	+ 0.1	67.7	38.4	4.62	8	— 4.21	2.09	15	202
Hanmer	1,270	50.8	— 0.7	75.0	29.0	1.41	9	— 1.93	0.57	30	178
Christchurch ..	22	54.3	+ 0.8	75.3	36.7	0.91	9	— 0.94	0.31	16	165
Ashburton	323	53.6	+ 1.0	79.8	32.0	1.89	6	— 0.52	0.64	18	172
Timaru	56	53.9	+ 0.9	68.2	37.8	1.23	7	— 0.43	0.34	5	157
Alexandra	520	51.0	— 0.1	71.3	29.0	0.18	4	— 1.17	0.08	15	195
Taieri	80	50.9	— 0.4	73.8	32.8	1.22	8	— 0 85	0.51	1	151
Invercargill airfield ..	0	51.2	+ 1.3	69.0	30.3	2.65	11	— 1.07	0.60	2	142
Chatham Islands ..	150	53.5	+ 0.4	61.8	42.8	1.99	20	— 0.58	0.44	13	

MAY

Kerikeri	240	58.8	+ 2.5	71.2	43.4	14.23	21	+ 7.04	3.25	15	106
Auckland	160	58.6	+ 2.0	69.7	45.6	5.01	17	+ 0.22	1.94	15	118
Tauranga	12	54.9	+ 1.3	69.7	36.5	7.15	14	+ 2.02	3.39	30	123
Ruakura	131	52.9	+ 1.5	69.3	28.3	5.21	15	+ 0.71	0.89	10	110
Whakarewarewa ..	1,006	51.2	+ 2.0	67.5	32.2	5.58	13	+ 0.08	2.22	30	94
Gisborne	14	54.6	+ 1.7	75.0	34.4	2.44	15	— 2.33	0.60	2	135
New Plymouth ..	160	55.6	+ 1.9	66.0	40.6	6.60	15	+ 0.53	1.52	15	143
Karioi	2,125	47.8	+ 2.3	65.2	27.0	3.98	13	— 0.04	1.06	9	
Napier	5	54.6	+ 1.8	75.0	36.2	2.53	13	— 0.81	0.66	23	133
Wanganui	72	53.6	+ 0.6	69.8	37.1	2.23	14	— 0.89	0.48	23	131
Palmerston North ..	110	52.4	+ 1.4	67.0	31.8	2.25	14	— 1.07	0.58	23	106
Waingawa	340	51.0	+ 1.5	67.7	30.0	2.72	19	— 1.33	0.77	23	100
Wellington	415	52.9	+ 1.6	65.3	38.8	3.38	17	— 1.18	0.76	30	98
Nelson airfield ..	5	50.4	+ 1.9	66.8	31.3	5.41	14	+ 1.97	1.19	30	166
Blenheim	12	50.8	+ 1.2	67.2	32.1	2.27	9	— 0.26	1.26	7	159
Hokitika	15	51.2	+ 0.3	65.1	33.2	12.00	16	+ 2.72	2.19	21	131
Hanmer	1,270	45.2	+ 0.4	67.5	25.5	1.51	12	— 2.97	0.58	22	104
Christchurch ..	22	49.7	+ 2.1	70.0	28.3	0.47	10	— 2.38	0.19	11	117
Ashburton	323	46.5	— 0.2	67.8	26.2	0.67	6	— 1.88	0.24	22	108
Timaru	56	46.8	+ 0.0	66.3	31.0	1.37	12	— 0.16	0.40	2	104
Alexandra	520	43.6	+ 0.7	65.5	20.0	0.74	10	— 0.17	0.23	21	104
Taieri	80	45.6	— 0.3	66.0	23.3	1.10	8	— 0.99	0.37	8	98
Invercargill airfield ..	0	46.0	+ 0.7	63.5	27.7	3.55	14	— 0.19	0.74	24	113
Chatham Islands ..	150	50.9	+ 0.3	61.0	38.0	41.5	24	+ 0.70	1.15	31	

Calves Reared on Buttermilk

(Continued from page 33)

If the calves were sold at the time this was written, they would have brought a net return of £7 17s. each, but Mr McKenzie wants them for pasture control when they are older. They will be sold as three-year-old springing heifers, which are now bringing up to £40 each.

Mr McKenzie has reared his calves very well and now has 39 well grown, good conditioned animals. The experience he has had has made him keen and he intends to rear a larger number of calves next season.

There is plenty of scope in Taranaki and other dairying areas to do as Mr McKenzie has done, as it seems impossible to satisfy the demand for well reared heifers. If care is taken to buy calves from tuberculosis-free herds and they are reared away from animals that might be affected, when they are sold as heifers they should give a negative reaction to the tuberculin test.

Mr McKenzie's results have shown that calf rearing on a sheep farm or a dairy farm can be a most profitable sideline.

Topdressing and Oversowing Tussock Country

WINTER topdressing and oversowing is now an established practice on all but the driest areas of the tussock country in the South Island. Seeding rates as low as 2 lb of Montgomery red clover, 2 lb of white clover, and 1 lb of alsike per acre, sown with the correct fertiliser, will generally produce a dense clover sward.

Sulphur and Phosphorus Deficiencies

The South Island tussock country has been shown to be generally highly sulphur deficient, as well as being deficient in varying degrees in phosphorus. It is therefore necessary to find out the relative importance of these two elements before deciding on the type of superphosphate to apply.

Ordinary superphosphate will not generally supply sufficient sulphur, and it also has the disadvantage that the small amount it does supply (in the form of gypsum) is readily soluble and subject to leaching.

Elemental sulphur is not available to the plant as quickly as gypsum, having first to be oxidised, but it will not leach from the root zone as rapidly.

Use of Sulphurised Superphosphate

Mixtures now available in which elemental sulphur has been added to ordinary superphosphate give a more concentrated and longer lasting effect on sulphur-deficient country.

This sulphurised superphosphate is available in two mixes—one of 400 lb of added sulphur to the ton and one of 224 lb.

Molybdenum responds on much of the tussock country and should generally be included in the initial sowings. When no clover is already present in the sward the seed should be inoculated.

—*R. L. BENNETTS,*
Fields Instructor,
Department of Agriculture,
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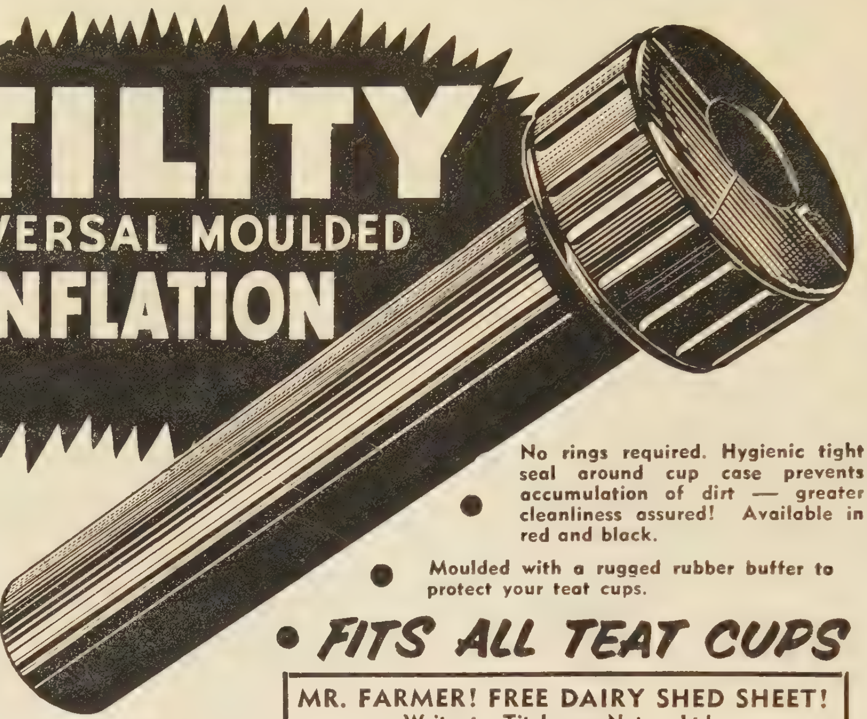

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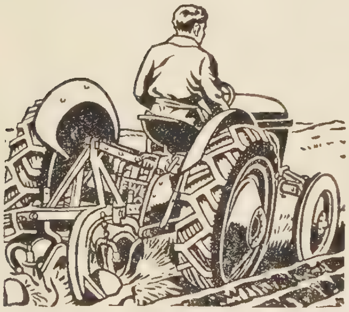

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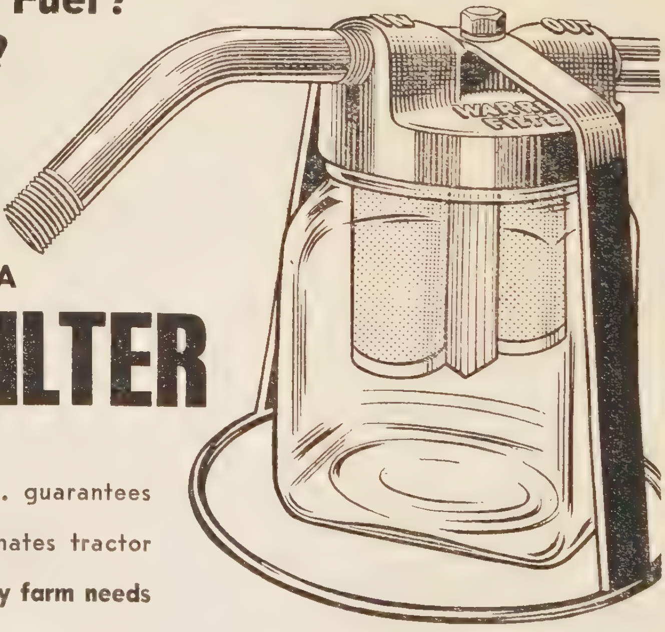

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The Home Garden in August

By A. G. KENNELLY,
Horticultural Instructor,
Department of Agriculture,
Dunedin

[Green and Hahn

THE extent to which sowings of hardy vegetables can be made in August depends on local conditions, usually largely on ground temperatures, which even in the milder parts of New Zealand are not high enough for large sowings of hardy vegetables to be an advisable general practice. Small sowings will ensure a continuous supply of fresh vegetables which is one of the main aims of home production.

THE importance of continuity of supply in the production of vegetables can hardly be overstressed and because in most gardens a break in supply is most likely early in the season when winter vegetables are exhausted and before the new season's supplies are ready, seed sowing or the setting out of young plants should be started in the new season as soon as possible. However, August sowings should not be extensive, because though conditions are usually sunnier in August than in June and July, soil temperatures are still comparatively low and frosts may be heavy; also, ground conditions, particularly where the soil is heavy or moderately heavy, are rarely consistently good throughout New Zealand in August and if there is a cold, wet spell after sowing, crops may fail.

Suitability of Soil for Sowing

The suitability of soil for sowing can be tested after it has been dug over. It is usually in the right moisture condition if it does not stick to the soles of the boots when it is walked on. If there is enough moisture, soil condition is less important for planting, but if the soil is inclined to be wet, it is better to work from a board laid on the ground than to walk on the surface when either sowing or planting.

Small sowings of most hardy vegetables can be made in well drained soils in favourably situated gardens where the ground has warmed enough. Seed of beetroot, carrots, Chinese cabbage, cauliflower, summer cabbage, kohl rabi, lettuce, leeks, turnips, radish, peas, salsify, scorzonera, spinach, silver beet, parsley, and many other herbs can be sown. Lettuces, silver beet and perpetual or spinach beet, early cabbages, cauliflowers, and

Sowing and Planting

Small Early Sowings

Only in favourable soils and situations: Beetroot, carrots, Chinese cabbage, cauliflower, summer cabbage, kohl rabi, lettuce, leeks, turnips, radish, peas, salsify, scorzonera, spinach, silver beet, parsley, and many other herbs.

Plant out

Rhubarb, asparagus, horse radish, lettuces, silver beet, onions, cabbages, cauliflowers, kohl rabi, Jerusalem artichokes.

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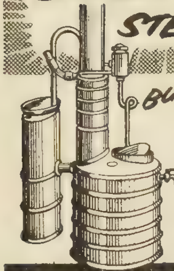

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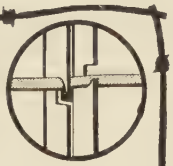

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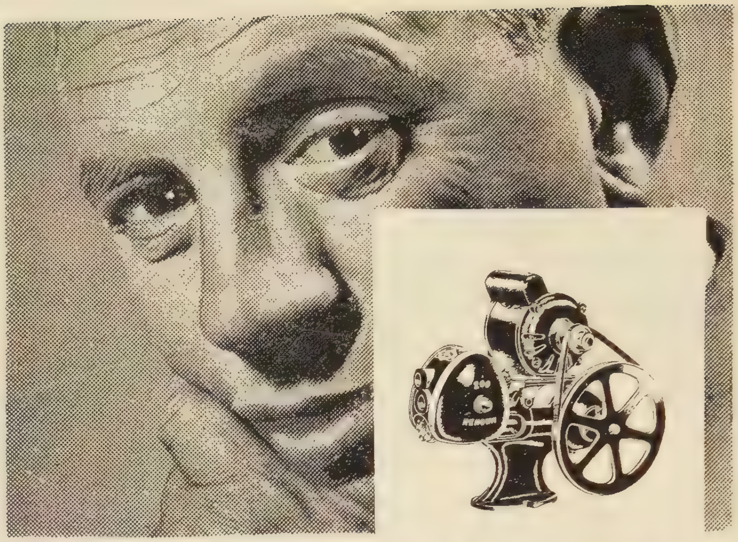

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NEW ZEALAND RAILWAYS

Success in Home Gardening

WHETHER some gardeners have "green fingers" is debatable, but it is true with practically all gardeners that success follows the observance of a few simple but fundamental rules or practices which, though they seem to the beginner involved and difficult to learn, are quite logical and straightforward. Most of them can be discovered by common-sense consideration of the needs of plants in the different stages of their growth. The little knowledge needed of varieties can usually be obtained quite simply from a good descriptive seed list.

Claims of extraordinary merit for secret manurial mixtures or garden practices usually need not be taken very seriously. The gardener who practises good husbandry, the essentials of which are common knowledge among successful growers everywhere, will succeed with most of the crops he grows.

The successful gardener does not necessarily need to have had great experience, though experience helps when unforeseen problems arise. Even the best growers have failures which may be due to weather, poor seed, or other factors over which they have no control.

onions can be set out in most districts and should mature quickly if strong, well rooted seedlings are planted in well manured soil.

In a few districts frost-tender plants such as tomatoes, cucumbers, marrows, pumpkins, and melons can be sown under glass to be ready for setting out when frost danger is past. Though the time taken to produce good plants for planting out varies according to the treatment given, tomatoes started in warm, favourable conditions usually take about six weeks and the other plants mentioned about half that time to reach a suitable state for planting out.

Sowing should be governed by the facilities available and the extent of damaging frost. It is not advisable to have plants ready too early. The date of commencement of planting out varies from about mid October to late October in some northern districts and to the second week in November in some southern districts.

Asparagus

In most districts August is the preferred month for setting out plants to establish a new bed of asparagus, as usually ground conditions and the plants or crowns to be set out are in the most suitable condition then. One-year-old seedlings are usually preferred, as they transplant better and establish more readily than the two-year crowns, which are considerably larger and therefore more subject to damage during transplanting. Crowns can be set out about 8 in. below soil level and the roots spread evenly over a small mound drawn up in the bottom of the trench.

The top bud should not at first be covered with more than 2 in. of soil, as a young plant is liable to be smothered and retarded if deeply covered before it has become established and sufficiently strengthened. Double rows are often planted in home gardens, though commercial growers prefer single rows. Crowns should be about 18 in. apart and rows at least 42 in. apart for single rows.

Built up or raised beds are an advantage where the soil is shallow or drainage poor. Good drainage is essential and the site on which it is intended to establish a bed should first be dug deeply. All perennial weeds should be removed. Where possible a good dressing of organic manure such as farmyard or stable manure or compost should be applied. A complete fertiliser (one containing nitrogen, phosphoric acid, and potash) is also advisable on most well worked home garden soils. It should be applied at up to about 4 oz to 5 oz a square yard.

Broad Beans

Broad beans can still be sown in districts where soil moisture is likely to be adequate up to the time of harvesting the crop.

Carrots

Seed of carrots can be sown as soon as soil conditions are favourable. In most home gardens several small successional sowings are preferable to one large one. Carrots are high yielding and grow well in deep, rich, well drained, and well cultivated soils that contain adequate well rotted organic matter. Popular varieties include Red Cored Chantenay, Taranaki Strongtop, and Nantes.

Onions

In most northern districts or where it is customary to sow the main crop in autumn, onion plants can be set out 3 in. to 4 in. apart in rows 12 in. apart in August. In most southern districts the main crop is sown in September, but in favourably situated gardens where soil conditions are good a small early sowing may be made toward the end of August.

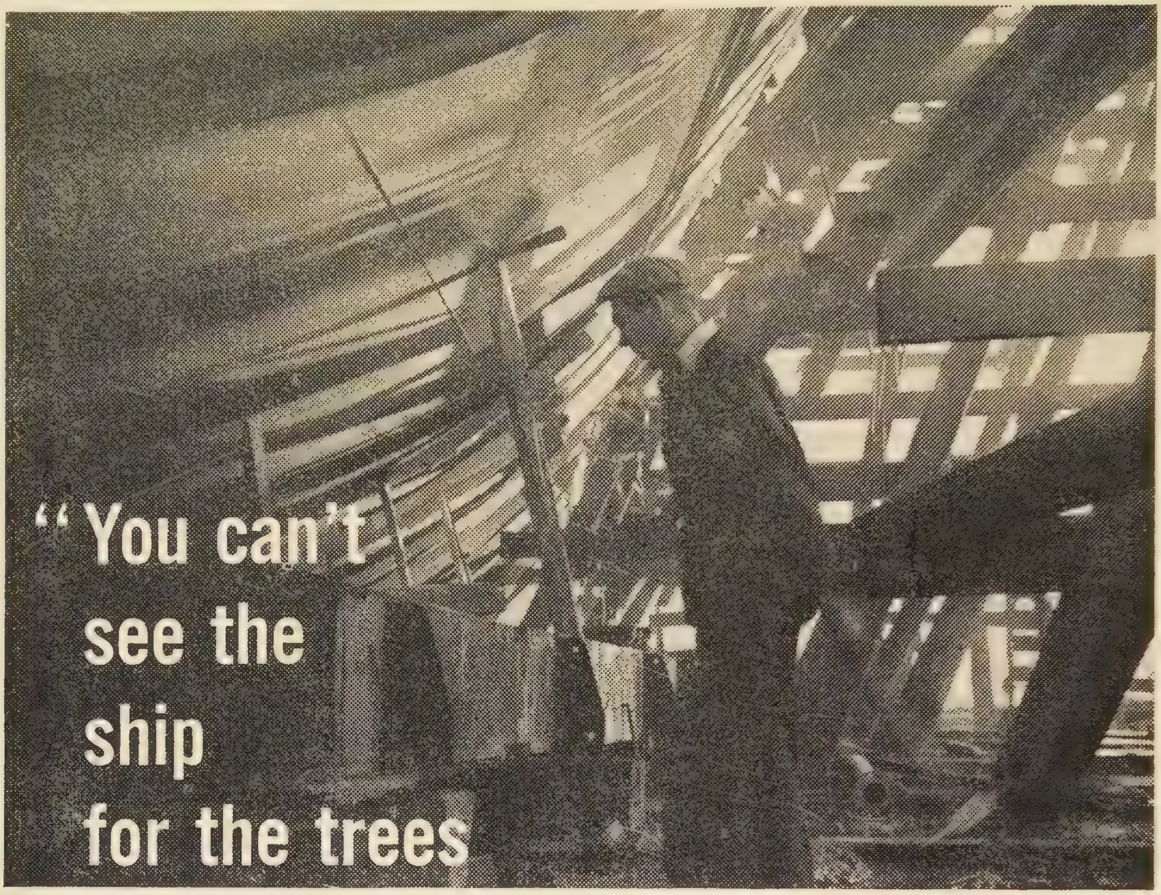
Peas

Where the soil is well drained and the aspect is favourable peas can be sown now, even in southern districts. However, nothing is to be gained and the crop may be disappointing if seed is sown in cold, wet ground. It is not unusual for crops sown in favourable conditions to mature before crops sown several weeks earlier under unfavourable conditions.

Peas do well in cool conditions and prefer a moist, well drained soil rich in humus. They repay good cultivation methods and the ground should be deeply dug and manured, preferably in autumn, with organic material such as stack bottom, compost, or farmyard manure. Dwarf varieties such as William Massey and Little Marvel can be grown without staking, but the rows should be kept earthed up. If, however, short sticks or suitable twiggy materials are available, dwarf varieties should be staked, because plants are usually better if given support.

Most varieties of peas can be harvested only for a comparatively short time. To obtain a succession it is usually advisable to make sowings at intervals of about three to four

NUMBER 2 IN A SERIES OF LETTERS ADDRESSED TO A SHEEP FARMER'S SON IN NEW ZEALAND



"You can't see the ship for the trees Tony!"

And they really *are* trees – or were. They're the trunks of great Columbia pines, 80 feet high, some of them, and so thick at the base you couldn't get your arms round them. We use them as main staging supports because wood stands up to hard knocks (and it gets plenty) better than steel. When it comes to materials, Dame Nature can still trump our aces, when she's a mind to.

But don't get the idea that all this scaffolding is holding the ship. It's there simply to enable the men to get to work and just now they're swarming all over her – platers and riveters and welders, all working like beavers to get No. 1290 ready for the launch. They're inside the hull, too – and if you could come in with me, you'd think I ought to have written 'hell' instead of 'hull'.

It's dark inside, except for the lamps slung here and there and the blinding spots of the welders' arcs. The floor is a litter of electric cables and compressed-air hoses, snaking about all over the place. And over on the port side there's the red glow of a forge, where a gang of riveters are working. You'd enjoy that, Tony. The three-inch steel rivets come cherry-red from the fire, into the holes in the plates, to be held in position by the man inside the hull whilst his mate outside uses a pneumatic riveter to hammer the rivets down. And the noise —! Imagine yourself inside a steel box, with someone slamming a sledge-hammer against the sides and you'll get the idea.

Over on the other side of the ship we've been building a bow section for No. 1290, cutting and bending half-inch steel plates as easily as you would work with cardboard. The job's nearly finished now and, with any luck, the whole section will be lifted into position and bolted down before the hooter goes tonight.

And then the men will go streaming out of the yard, back to their homes in the little back streets, with another day's work behind them. They're good chaps – I've known them for more years than I'm going to tell. But do they ever stop to think that the very job they're working on today will be bringing them their meat and their cheese and their butter and their fruit a year or two from now? I wonder, Tony. . . .

NEW ZEALAND OVERSEAS SHIPPING LINES

SHAW SAVILL & ALBION CO. LTD · PORT LINE LIMITED · THE NEW ZEALAND SHIPPING CO. LTD · BLUE STAR LINE LIMITED weeks of varieties having nearly similar maturity periods or to sow at about the same time several varieties each of which will mature its crop in succession.

Seed should be sown 1½ in. to 2 in. apart in V-shaped or broad, flat drills, which can be drawn out with a hoe 18 in. to 30 in. apart according to variety. Drills should be 2 in. to 3 in. deep except where conditions are hot and dry, when they should be considerably deeper so that though the seed should not be covered by more than 1½ in. to 2 in. of soil, the roots will be well down in the lower, cooler, and moister soil levels.

Potatoes

It is much too early yet in most districts to plant main crop potatoes, but tubers can be set to sprout in a box in a light, airy, frost-free shed or outbuilding. Well sprouted tubers planted shallowly in well drained soil in a favourable situation send shoots above the ground more quickly than unsprouted ones. Frost is likely in many districts until late October and in some southern districts until early November and shoots of tubers planted in August are likely to be destroyed unless continuously earthed up.

For early maturity an early variety should be chosen. Popular early varieties include Epicure and Arran Banner, but there are other good varieties well suited to specific locations. Where space permits a good plan is to try out several varieties.

Early potatoes can be set 10 in. to 15 in. apart in the bottom of trenches 4 in. to 5 in. deep and 24 in. apart. If tubers planted very early are set deeply, they usually respond slowly because of the colder ground temperatures; if planted shallowly, they must be regularly earthed up to prevent frost damage.

Earthing up protects the tops from frost, but normal development is impossible unless the plant can develop green leaves, with which in the presence of light it manufactures sugar, which it builds up into starches and other substances. The advantage of early planting therefore lies mainly in the development of the underground system, which even if of only moderate size, forms an excellent basis for development when frost danger is past.

Because of its freedom from disease, Government certified seed is recommended, but in districts where disease is not specially troublesome and good-sized certified seed is difficult to get, some home gardeners prefer to use medium or large tubers from a disease-free crop for early planting, because, other factors being equal, large tubers usually produce large plants earlier than small tubers.

[*Green and Hahn*

It is not too late to plant broad beans where the soil is not likely to dry out before the crop is mature.

▼ Kohl rabi is closely related to cabbage, and seed can be sown or plants set out in July or August.

[*Green and Hahn*

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[*Sparrow*

Large clumps of dormant rhubarb consisting of many crowns can be lifted, divided, and replanted in August.

If the tubers are to be cut, at least two eyes should be left on each section and planting should be done immediately after cutting.

Rhubarb

August is a good month to establish a new rhubarb bed or to break up and replant an old one. Rhubarb is hardy, easy to grow, and yields heavily if well supplied with moisture and plant foods. The soil should be well drained and preferably well supplied with organic matter. The lighter soils that dry out are less suitable than the heavier, well drained soils.

In New Zealand varieties can be grouped as early, main crop, and ever bearing, though in good soils that do not dry out most varieties can be grown throughout the year. Rhubarb can be raised from seed, which is usually sown in spring as soon as the soil has warmed enough, but to obtain varieties true to name plants for new plantations must be obtained from the breaking up of existing crowns.

Except in specially favoured situations rhubarb should preferably be lifted every four or five years, as the large roots or crowns tend to become hollow and weakened if undisturbed for longer periods. After lifting, the crowns should be divided with a sharp spade.

Shallots

In the home garden shallots are mainly grown for pickling or flavouring. They are easily grown and prefer a well drained soil in a sunny situation. Culture and harvesting of shallots are similar to that for onions except that shallots are increased by offsets or cloves and can usually be set out earlier than onions.

May is often favoured for planting, though the common rule for culture of shallots is to plant on the shortest day and to harvest on the longest. The shallot is a particularly hardy vegetable, and because it is planted as a small bulb, it is better adapted to stand rigorous conditions than plants of closely allied families which are grown from seed. However, planting on the shortest day is of little advantage if soil conditions and weather are unfavourable.

Bulbs should be graded according to size and planted 5 in. to 8 in. apart in rows 12 in. apart. Each bulb should be pressed firmly sufficiently far into the soil to keep it in position, though some growers prefer deeper planting and set bulbs to half to three-quarters of their depth. If bulbs are set deeply, the earth should be drawn away from them as they mature. Any flower heads that arise during the growing period should be removed.

New Fields Superintendent at Palmerston North

MR A. STUART, Assistant Fields Superintendent in the Department of Agriculture at Dunedin, has been appointed Fields Superintendent in the Department at Palmerston North. He succeeds the late Mr C. J. Hamblyn.

[*Campbell*

Mr A. Stuart.

Mr Stuart joined the Department of Agriculture as an Assistant Instructor in Agriculture at Ruakura in 1927. Since then he has been associated with farming in the South Island, specially in Otago and Southland, having served as an Instructor at Gore, Alexandra, Dunedin, and Invercargill. He was appointed Assistant Fields Superintendent at Dunedin in 1946.

As Fields Superintendent at Palmerston North, Mr Stuart will be in charge of the Department of Agriculture's farm advisory work in the lower half of the North Island, including Taranaki and the East Coast.

ROUND THE RESEARCH STATIONS

Current Work and Findings
in
Department of Agriculture and
Department of Scientific and
Industrial Research
Trials and Experiments

Ruakura

Winter Management of the Dairy Herd

Two herds of identical twin cows are being used at Ruakura Animal Research Station to contrast two systems of wintering. The more orthodox method of saving a small quantity of autumn-saved pasture and the feeding of hay and silage reserves late in winter is being compared with one in which reserves are fed out in late autumn-early winter, during which a large enough area of pasture is saved to feed grass alone from mid June onward.

Apart from providing information on the differences in overall production between these two systems, observations are being made on the effect of feeding cows before calving on a silage ration as against an all-grass one. Records are also collected on the incidence of metabolic diseases and of pasture production. Keen interest is being taken, too, in the amount of pugging, both by stock and machines, which occurs under the two systems of wintering.

Plant Chemistry Division

Pitfalls in Control of Bloat by Spraying

Since an article on the prevention and treatment of bloat appeared in the July 1959 issue of the "Journal" many farmers have adopted with complete success the method of spraying pastures it recommended. In every case where failure to achieve complete control was investigated by the Plant Chemistry Division of the Department of Scientific and Industrial Research it was found that the farmer had failed to carry out the procedure correctly.

The most common faults were:

1. Spraying with material that had not been properly emulsified. This was mainly due to use of the wrong type of emulsifying agent, that is, the detergent used for cleaning milking machines. The emulsifying agents recommended are:

"Lissapol NX" or N300, "Standard Vacuum CN", "Shell p.40".

When the fat or oil is not completely emulsified it floats on top of the water. This means that during spraying a large area is covered with water and only a small area at the end receives the concentrated antifoaming agent. It is not easy to tell whether a proper emulsion is formed by looking in the top of the drum. If there is any doubt, the mixture should be collected in a tin as it comes through the nozzles and examined to see whether it is in the form of an emulsion.

Care must be taken to ensure that the hoses and pump are properly connected without air leaks; otherwise air bubbles can cause frothing rather than the formation of an emulsion.

2. The average rate of application of emulsified fat or oil necessary to control bloat is 3 oz per cow per day. Where a farmer has short pasture or has to spray a large area the rate probably will have to be increased to 4 oz per cow per day. Several farmers have achieved complete control with 4 oz where 3 oz was found to be insufficient.

3. The wrong nozzle size has sometimes been used on the spray boom. The recommended sizes are M 32 or M 39.

Where nozzles or filters have blocked when tallow is being used, the fat and water have not been hot enough during emulsification. If foreign matter is present in the fat, it must be strained out after melting. Where clean water, fat, and good drums are used the spraying procedure with fat can be used without even a foot filter in the drum.

Another Method for Emulsifying Oil

In the July article a rather complicated set-up for emulsifying oils with an auxiliary oil feed tank was given. This method produces a good emulsion with the minimum amount of detergent. Just as good an emulsion can be obtained with a little more detergent if the oil is placed in the drum with about 2 gallons of water and the detergent. The concentrated mixture is then circulated through the pump and back into the drum, preferably through a nozzle to give a jet of water under pressure. A fine emulsion quickly forms which can be diluted with cold water while circulation through the pump continues.

Comparison of Bloat Remedies

Trials have continued with various compounds to test their efficiency in preventing bloat and for speed in deflating bloated animals. The best to date is "Bloat-Enz".

A number of farmers use Rawleigh's "Colic Ease" (for horses) for relieving bloated cows. This has been found to be inferior to "Bloat-Enz" for controlling bloat in cows. The Dairy Research Institute has shown that "Colic Ease" causes a pine taint similar to eucalyptus in the milk, cream, and butter from the next milking. Such milk from one or two cows can be downgraded at the factory.

Rukuhia

Fungicidal Treatment of Lucerne Seed to Control "Damp-off" Disease

During pot trials at Rukuhia Soil Research Station to investigate the reason for the poor establishment of lucerne on certain pumice soils it was found that "damp-off" disease killed many of the plants when conditions were wet. In addition to losses through plants dying many of those surviving were seriously retarded by damp-off injury to the roots. In particular, injury to the tap root resulted in a shallow branching root system without the deep tap root typical of lucerne that aids its establishment in light, dry soils.

In the light of these observations trials were conducted in which the lucerne seed was treated with various fungicides. It was found that pelleting the seed with lime and thiram gave very good control of damp-off. This treatment increased the number of established plants from 15 to 60 plants per 100 seeds sown. In addition plants from pelleted seed were much larger and did not suffer root injury. The thiram treatment did not adversely affect nodulation of the lucerne.

Trials have been recently laid down on pumice soil at the Department's experimental area at Wairakei in which various methods of incorporating the fungicide and inoculum with the lucerne seed are being compared under field conditions.

Wallaceville

Hyperkeratosis or Wrinkly Skin Disease of Cattle

Hyperkeratosis or wrinkly skin disease was responsible for heavy losses in cattle in the U.S. between 1941 and 1950, when it was eventually proved to be a chronic poisoning with pentachloro-naphthalene and hexachloro-naphthalenes. Penta- and hexa-chloro-naphthalenes are used as wood preservatives and were once included in certain lubricating oils. These substances are extremely toxic to cattle, 1 gram per 300 lb bodyweight being sufficient to cause death of a cattle beast or render it useless.

Heifer showing severe loss of condition, weeping from the eyes, and scouring after access to pentachloro-naphthalene.

Odd cases of this disease have been seen in New Zealand from time to time, but heavy loss was recently experienced by a farmer who sprayed the woodwork in the roof of his hayshed with a wood preservative of this type. The baled hay in the shed at the time was not sprayed directly but was contaminated by drift and perhaps a little drip from the roof.

This hay was later fed out to Aberdeen Angus yearlings, dry and in-calf cows, and adult bulls. It resulted in the death of over 20 yearlings, two adult cows, and one bull, and there were 20 abortions. The remaining yearlings were severely affected and it was doubtful if they would recover.

Farmers buying wood preservatives are warned to inquire into their chemical composition and to be extremely careful with any substance of this nature.

Care of Livestock during August

By the Animal Research Division

CARE OF THE CALVING COW

COWS about to calve should be brought into a handy paddock so that they can be kept under supervision. If a cow has difficulty in calving veterinary assistance should be sought. This should be done as soon as it is obvious that the presentation is not normal and at least within six hours of the beginning of labour. Unskilled interference exhausts the cow and makes the veterinarian's task more difficult or even impossible. Veterinary assistance should also be sought if the cows do not clean within 48 hours. Do not hang weights on the afterbirth.

FEEDING AFTER CALVING

Autumn-saved pasture is the best food for newly calved cows, but it must be grazed in small breaks which the cows will clean up in about two hours. They should continue to receive as much silage as they will eat and if the pasture is short and sappy, they should also receive hay.

CALF REARING

Calves should be fed their own mothers' milk for at least the first two days. This is important, as the first milk, known as colostrum or "beastings", contains substances which increase a calf's resistance to scours. Jersey calves need 7 pints daily of whole milk for two to three weeks and thereafter this quantity or its equivalent in skim milk (2 gallons) will suffice until weaned. As soon as calves are proficient bucket feeders the above quantities can be fed once a day.

If scours occur, a supply of a sulpha drug should be obtained from a veterinarian immediately, as the drug is very effective when used promptly.

Calves should not be kept in a calf paddock. When two to three weeks of age they should be rotationally grazed ahead of the cows. This will ensure that they always have access to good fresh pasture, which they will eat readily. Where good pasture is available calves can be weaned quite satisfactorily at eight weeks.

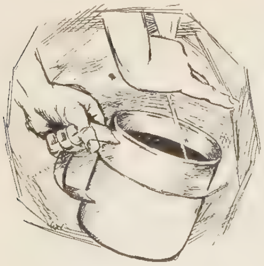
Further information about the good rearing of dairy stock is contained in the Department's Bulletin No. 228 (1s. 6d.).

REDWATER IN CALVES

If calves are being lost from redwater (leptospirosis), a veterinary surgeon should be called to treat affected animals and to advise on prevention of further losses by the use of protective serum or vaccination.

MASTITIS

Milk from each quarter should be examined with a strip cup before milking. If it shows any abnormality, or if the udder appears inflamed, treatment with penicillin should be begun at once. Three tubes of 25,000 units should be injected at 24-hour intervals, even if the milk appears normal after the first tube. Prompt treatment early in lactation will often save a quarter which otherwise might become weak or even blind.



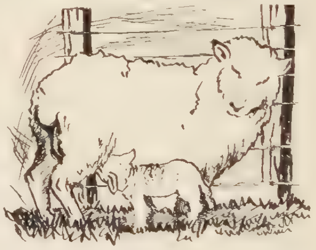
SELECTION OF CALVES FOR REPLACEMENT

The full sisters of high-producing heifers should always be kept, as should the daughters of Merit Sires with a high progeny test. Provided they are sturdy, the calves of very old cows with good life-time performance should always be kept, and there is no reason why the calves of well bred heifers should not be kept. The heifer twin of a bull calf should never be kept. Twin heifers especially if they are born early in the season, may be kept with safety, provided they are not too small.

CARE OF LAMBING EWES

About 10 per cent of all lambs are either born dead or die during the first week. These losses can be reduced by careful shepherding. Many lambs and some ewes can be saved by skilled assistance during lambing. Always use a reliable lubricating antiseptic on hands and wrists. Faulty presentations must be corrected. A lamb should never be forcibly pulled away when a leg or its head is turned back. A number of lambs die from suffocation through the cleanings remaining over their nostrils; these are very easily removed.

Where necessary lambs should be assisted to get a drink. This is particularly important where ewes have very large teats. Drawing away a few squirts from these will reduce their size and enable the new-born lambs to suckle. Ewes with very large teats, very small teats, badly placed teats, or defective udders should be marked for culling. A big percentage of their lambs will die. Many lambs which die during cold or wet weather would survive if they got a good drink soon after birth.



STERILITY IN COWS

If difficulty was experienced in getting cows in calf last summer, now is the time to seek veterinary advice with a view to preventing similar trouble this year. Facilities for diagnosing infectious infertility are available at both Wallaceville and Ruakura. Specimens must be submitted through veterinarians or Livestock Instructors. Effective control depends on accurate diagnosis.

Seasonal Notes

By Farm Advisory Division

NITROGEN FOR GRASS SEED CROPS

BECAUSE of the high cost of nitrogenous fertilisers in New Zealand, their use on grassland can be justified economically only for purposes such as out-of-season grass production, winter grass production on town milk supply farms, and grass seed production.

Paddocks for grass seed production are usually closed from late September to mid October. The paddocks are first grazed well down, preferably with sheep, and are then harrowed and left.

Correct timing of the application is important to get the best out of a nitrogenous fertiliser. It is as well not to topdress the paddock when it is first closed. Leave the paddock for about two weeks; the soil will be warmer and the grass plants will have put forth some growth and will be better able to utilise the applied nitrogen. The grass plants will then tiller well, put up more seed heads, generally grow more vigorously, and thus produce a higher yield of seed.

The best types of nitrogen to use are sulphate of ammonia and one of the commercial ammonium nitrate-lime mixtures. They are cheapest per unit of nitrogen. Organic nitrogen such as blood and bone acts too slowly for grass seed production and costs more per unit of nitrogen.

From 1 to 2 cwt per acre of sulphate of ammonia or its equivalent may be applied. This rate will produce extra seed, which will more than pay for the outlay on nitrogenous fertiliser.

Apart from increasing seed yield per acre, use of nitrogen improves seed quality and seed dresses out better.

—*C. J. CHRISTIE, Palmerston North*

* * *

BURY CROP RESIDUES TO REDUCE DRY ROT

IN an effort to control dry rot the residues of all brassica crops should be buried by ploughing under; discing and other surface cultivation should be avoided. Dry rot may cause serious losses in swedes and turnips; it also affects rape, kale, chou moellier, and other brassicas, which are also carriers of the fungus.

The disease attacks the leaves, stems, or bulbs of these crops, causing varying degrees of rotting in root crops and a somewhat less destructive condition known as "blackleg" in the leafy crops. The fungus carries over from one season to the next on crop residues and for this reason heavy dry rot losses are likely in the second of successive crops of swedes and turnips or in crops which follow other brassicas in the rotation.

Kale, chou moellier, or rape crops sown after swedes are often almost entirely affected with the blackleg form, which may have little effect on the crop and pass unnoticed. There is, however, a rapid build-up in the disease, and residues of these second crops are a particularly prolific source of dry rot spores in the following year.

Recently it has been discovered that the spores released from these residues can be carried for considerable distances by wind and failure to bury all such residues may result in dry rot damage to swede and turnip crops over a wide area. Similarly residues left on the surface after the sowing of pasture with a cover crop of rape, kale, or turnips could result in dry rot infection of root crops sown nearby.

To reduce the losses caused by dry rot residues of brassica crops should not be left on the surface to liberate windborne spores.

—*S. M. J. STOCKDILL, Palmerston*

* * *

CARE OF SEED POTATOES

AT this time of year seed potatoes are being graded and efforts should be made to ensure that a satisfactory sample is made by removing all diseased, misshapen, damaged, and moth-infected tubers as well as grading to standard sizes which have been adopted to allow for ease of mechanical planting. Avoid causing more damage to the seed at this stage, as this will be showing up badly by planting time.

In districts where frosts occur the graded seed must be stored in shelter. Ideal places can be found under the sunny side of trees. Provided seed potatoes are well covered, they will keep better outdoors than in poorly ventilated and dark sheds or stores, where there is often too much warmth. Storage rots are frequently the result of poor storage conditions. Tubers affected in this way are usually soft and when cut show a dark or grey ring just beneath the surface.

Once the risk of severe frost is over the bags can be laid out along the sheltered side of fences. Occasional turning will prevent excessive sprouting. This is important with some of the newer varieties. Removal of long sprouts often leaves the seed weakened and poor emergence will result.

Dipping in fungicides just before planting to control corticium is becoming more common in many districts.

Seed which has been sprouted in good conditions of light has small, firm, green shoots and will give earlier crops than unsprouted seed.

—*N. H. GREAVES, Timaru*

* * *

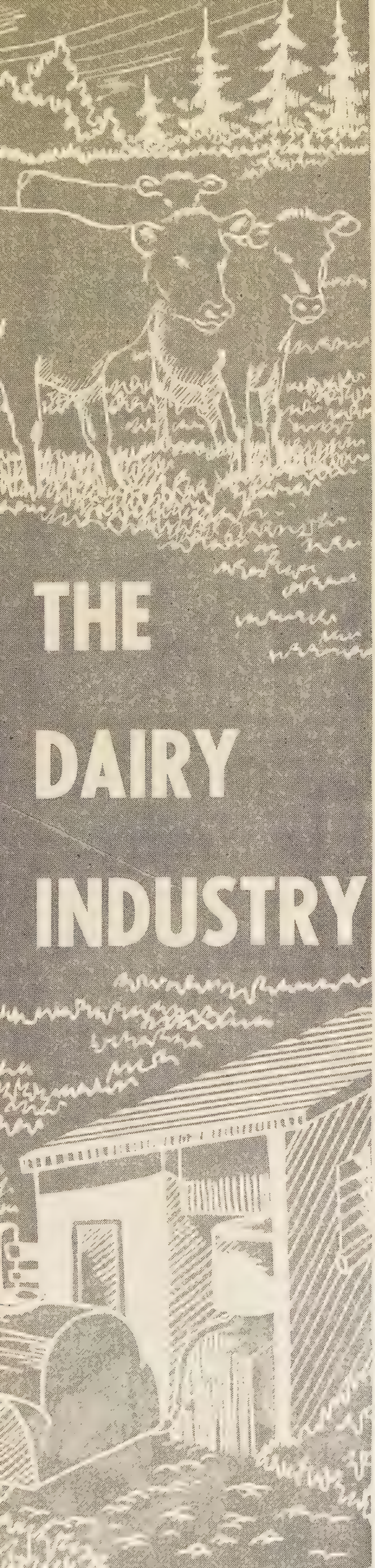
WEED CONTROL IN PASTURES

THE prevalence of certain weeds in a pasture may be the sign of a particular need. Improved drainage and less winter pugging will do much to reduce pennyroyal and buttercups; where flatweeds, dandelions, and ribgrass abound a shortage of potash is often likely, and until potash is applied use of hormone weedkillers will do little to increase pasture growth.

Where thistles are increasing, which is a sign of high fertility, use of hormone weedkillers is most effective. However, some of the high fertility weeds, including docks and Californian thistle, are harder to control.

Pastures should generally be sprayed in early spring, when the weeds are small and leafy and before clovers start growing. MCPB and 2,4-DB are the hormones to use on weeds in new grass, because they do not harm young clover plants.

—*G. B. HADDOW, Auckland*



50th Jubilee Supplement 1910-1960

THE publication of the first issue of the "Journal of Agriculture" in 1910 saw the dairy industry in a position of moderate strength and with a record of technical progress at least equal to that of any other country. Dairy farmers had consolidated the position they had carved out for themselves during the previous half century, farming was slowly becoming a matter of specialisation, creameries and cheese factories had become an established part of the rural scene, and, above all, refrigeration had solved the one-time insuperable problem of getting New Zealand's dairy produce to a market 10,000 miles and more away. The time was obviously ripe for the consolidation and developments which the dairy industry and the Dairy Division have undertaken and recorded during the 50 years of the life of the "Journal".

TO choose a series of milestones in the path of these 50 years is in some ways too easy a task. One need only look at the accompanying photographs to realise this. The farm dairy of 1910 and the electrically operated, concrete paved farm dairy of today are miles apart, yet many milestones mark the road of improvement. The use of better building materials, the almost universal availability of electric light and power, the adoption of mechanical milking processes, and the use of refrigerated tanks are all noteworthy in themselves; yet these are only a fraction of the improvements which have taken place in the over-all job of efficient milk production.

Similarly in the processing and manufacturing side of the industry: Creameries like Morrinsville and Rangataiki Plains, beautifully equipped milk powder factories like Kerepehi and Waharoa—as large if not larger than anything comparable in the world—are a far cry from the tin-roofed, moderately-equipped factories of 1910. Even the products they produce are far removed from the butter and cheese referred to in early "Journal" articles.

Butter is, perhaps, still butter, but today the industry offers in addition dehydrated butterfat, butter oil, buttermilk powder, frozen cream, tinned sterilised cream, and other products. Cheese, once offered only as Cheddar cheese, is today made in variety as blue-veined, Cheshire, processed, Gouda, rindless, Colby, and many more. Casein, lactalbumin, and lactose are now all big earners of overseas funds; in 1910 they were merely names in the textbooks on the shelves of analytical chemists. Milk powder, a major product of the industry today, is now produced at the rate of nearly 70,000 tons a year. In 1910 the total output for the whole of New Zealand was well under 2,000 tons.

To condense the progress of half a century into a few words becomes then a task of omission and if some aspects are dealt with more summarily than others, it will only be to allow the principal milestones to be seen more clearly. The major changes may be classified under six main headings ranging in scope from the improvements effected in production to the changes which have taken place in the industry's market milk section. The Department feels proud to have collaborated with the industry in initiating these changes and in recording many of them in the "Journal" in its 50 years' history.

Milk Production Methods

Milk production in 1910 was already a well organised farming operation. Dairy breeds were well established and articles in the 1910 and 1913 issues of the "Journal" recorded the formation of the New Zealand Holstein-Friesian Breeders' Association and the New Zealand Shorthorn Breeders' Association respectively.

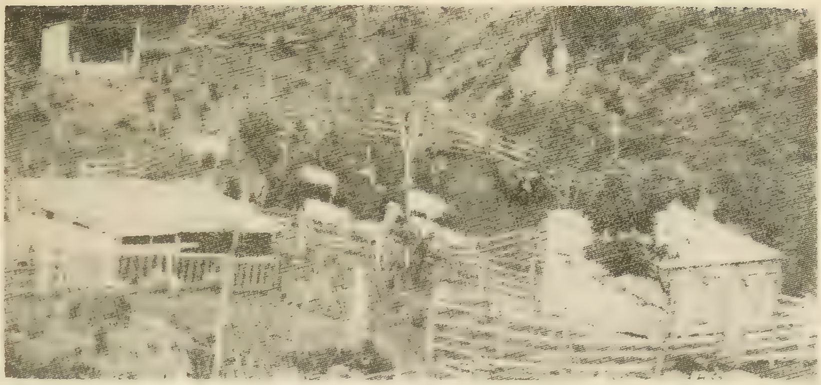
Herd testing had just started and farmers were beginning to realise that good stock management aided by the information made available by the Department could pay off in improved returns from the dairy factories where they sold their milk and cream. The dominant breed then was the Shorthorn, which in the last half century has been supplemented by the Jersey, though during the past decade some farmers, particularly those supplying milk for the city market, have tended to introduce high-producing Friesians and Friesian crosses into their herds. The lack of any payment-on-quality system in the market milk industry until quite recent years has perhaps encouraged this trend.

The introduction of herd testing, at first locally and later on a country-wide scale, has done much to enhance the milk production capacity of New Zealand dairy herds. Herd recording, first introduced in 1909-10 by the suppliers of the Dalefield Dairy Company, with the active encouragement of the Department, soon grew into a major activity of the industry and the Dairy Division and by 1926 sufficient herd testing groups were operating to justify the formation of a federation. In 1929 a herd testing central executive was formed to allocate herd testing subsidy funds received from the Government.

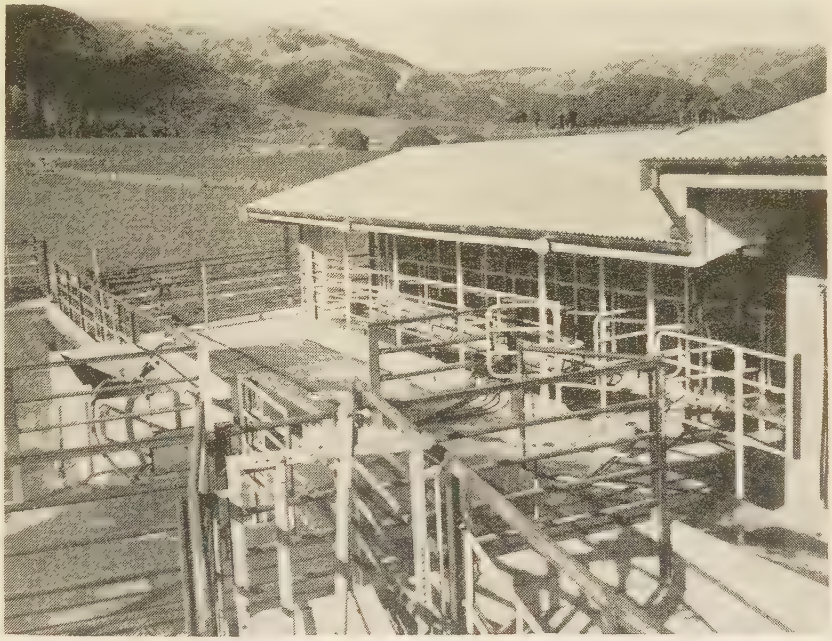
The interests of pedigree breeders were covered by the introduction of the Certificate of Record test as far back as 1912 and the later introduction (1927) of the Government Official Herd Test, which was intended to provide breeders with a herd test at a lower fee than that for the C.O.R. test. The Government Official Herd Test proved less popular than had first been expected and it was not until the past decade that any real trend has been shown toward the entry of whole herds under the O.H.T. scheme.

In 1936 the group herd testing federation came under the control of the then recently reorganised Dairy Board, though the federation continued in existence until the adoption of the Herd Improvement Plan by the Government and the industry in 1939. In 1951 both the C.O.R. and O.H.T. milk testing and recording systems were taken over from the Dairy Division by the Dairy Board. Articles in the 1913, 1927, 1935, and 1951 issues of the "Journal" record the acceptance and support rendered the milk recording schemes over the years and the results are evinced in the outstanding productivity of New Zealand's dairy farms today.

COWSHEDS — 1910 and TODAY



▲ Cheap, close-at-hand materials were used mainly in the construction of this cowshed on a Hokianga farm about 50 years ago.



▼ By contrast in the modern shed concrete and steel predominate and electricity and a pressure water supply are facilities that are virtually taken for granted.

Instruction Service

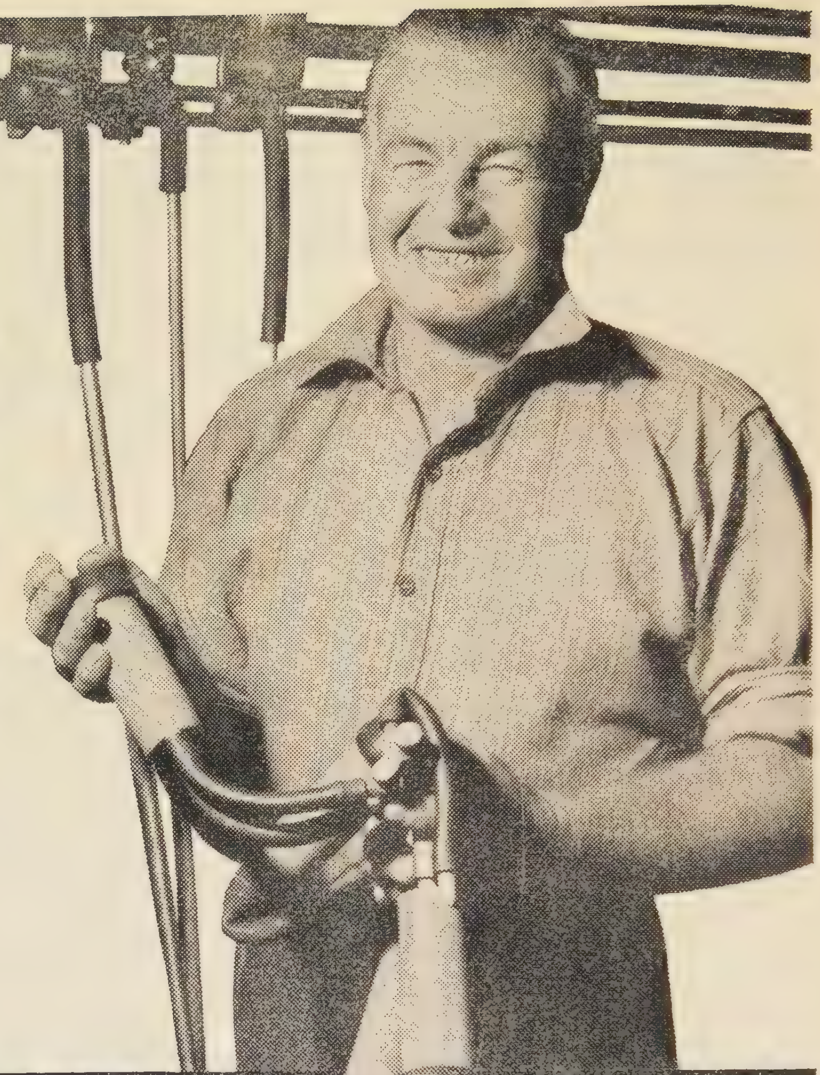
While dairy farmers were breeding for more and richer milk they were not unmindful of the need to watch the bacteriological quality of their product. The Department was well aware of the need for improvements in sheds and milking practices 50 years ago. The need for better sheds was emphasised by the issue to dairy farmers in 1919 of a model plan of a milking shed. This was supplied free by the Dairy Division and a note in an issue of the "Journal" the same year drew attention to the help dairy farmers could obtain. The Department steadily expanded its farm dairy instruction service in this and other directions to help farmers.

Though the farm dairy instruction service of the Dairy Division was first introduced in 1909, the real extension of the service took place only in the half century under review. The service in 1910 was still sufficiently novel to warrant the comment in the first volume of the "Journal" that "the settlers continue to work hand in hand with the Department and an application has just been made by another large dairy company in Taranaki for an instructor to visit the farms of its suppliers."

This Departmental service has recorded few organisational changes during the years—the changes have nearly all been in the technical field of practical advice—and the universal application of the service was seen, in 1910, to be only a matter of time. Though the event is not specifically mentioned in a "Journal" issue of that year, 1938 saw the official application of the service to the whole of the country.

The most notable advance brought about by the farm dairy instruction service has undoubtedly been the improvements effected in the design and construction of farm dairies. A glance at the illustrations appearing in this article will show the step-by-step improvements in design.

"happy John Quinn" proves success of the Sealed Milking Unit!



SEALED MILKING UNIT

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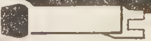
Get up to date and install the S.M.U. Sealed one piece ready to use Milking Unit, unbreakable plastic, with nitrile rubber liner. No vacuum leaks, factory adjusted for tension. Only 7/6d. each, less than the annual replacement cost of inflations.



"S.M.U." replaces old style Teat- cups, Inflations, Nipples and Nuts, Mouthpiece Rings, etc.

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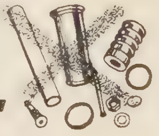


Available from all stockists of dairy farmer's requirements.

However, good buildings are only one means of improving milk quality at the point of production and over the years the Department has steadily insisted on the use of hygienic milking practices. This insistence has paralleled the growth of quality consciousness on the part of the consumer of New Zealand's dairy produce. The Department, however, has continued to exercise its legal powers in this regard in a manner which inflicts penalty only on the farmer who persistently refuses to remedy defects in his building structures and milking techniques.

The use of milking machines was already moderately widespread when the "Journal" first appeared. An article in an issue of 1921 reported that in a survey during 1920 it was found that almost exactly 25 per cent of milk suppliers were then using milking machines. These numbers grew rapidly and with the boost given by rural electrification and the desire of the milk producer to make his life less arduous, it was perhaps inevitable that the milking machine should become a standard fitment in every commercial shed in the country. The cleaning of milking machines posed special problems, but these were successfully tackled through the Department's farm dairy instruction service.

One of the first issues of the "Journal" carried an article on creamery buttermaking. The article is interesting in its own right, but is doubly so for a reference in passing to the growth of the home separation system. The author was not a supporter of the system and recorded that "it was regrettable to notice that the practice [of home separation] is now being adopted in the older and more settled districts" whereas formerly the practice was in use only where poor roads and scattered supply areas made whole milk collection impracticable. However, home separation gained in popularity among suppliers to butter factories, and within a few years it had become wellnigh universal.

Trend Reversed

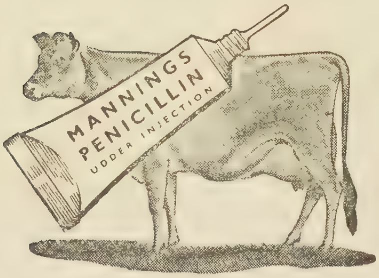
By the 40s, though, the growing demand for milk solids caused the cycle to reverse itself and today much of the milk previously home separated is transported in bulk to dairy factories where it is either dried into full-cream powder or is separated into cream and skim milk, the cream being made into butter and the skim milk into skim milk powder. The prognosis made in the article quoted that home separation would inevitably lead to the production of low grade butter was not borne out in practice. Much of the credit for this must go to the Department's farm dairy instruction service.

DELIVERY OF MILK TO FACTORIES — 1910 and TODAY

▲ 1910: Milk cans are still widely used, but horse-drawn wagons have virtually vanished.

▼ TODAY: Tanker collection from farms has steadily gained ground since its introduction about 10 years ago.

MANNINGS



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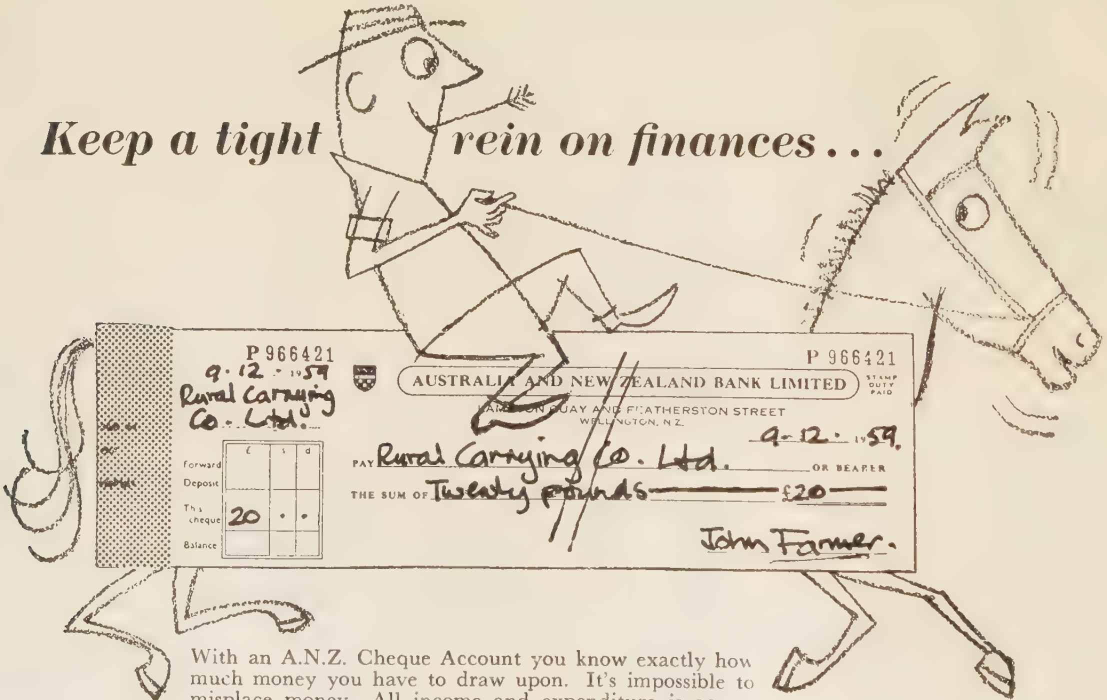

P 966421
9 . 12 . 1959
Rural Carrying
Co. Ltd.

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Deposit			
This cheque	20	•	•
Balance			

P 966421

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Six-horse teams hauling cheese from factory to ship at Patea about 50 years ago.

An illustration on page 51 showing milk cans on a wagon will bring back familiar memories to many older readers of the "Journal". Collection of the milk in cans was the accepted practice and though it is still the most widely used method, it is slowly giving place to collection by bulk milk tankers. The 50s saw the introduction of the change and it seems likely that when the "Journal" reviews its next half century an illustration of milk cans on a truck will cause the dairy farmer of the 21st century to laugh a little at the archaism of the 20th century's methods of collecting milk. Farm refrigeration, seldom used in 1910 but increasingly used in 1960, would seem to make this change inevitable.

Cooperative Dairy Company Development

The organisation of the dairy industry's factories and creameries on exclusively cooperative lines is uniquely a New Zealand development. The universal adoption of the principle was taken as a matter of course in a lengthy article in the very first issue of the "Journal".

The author, in his "Formation and Working of Cooperative Dairy Factory Companies", stated that the cooperative dairy factory was already a well established institution in every province in the Dominion and that many of these had been in existence over 20 years. He added that it could almost be said that (at the time of writing) the whole of the butter and cheese made in factories in New Zealand is made on cooperative lines.

The position noted then has not changed appreciably over the years. The cooperative movement has, in fact, strengthened itself and today all dairy factory operations, except one or two associated more with the production of patent foods than with the development of the dairy industry, are carried out in factories owned exclusively by the milk producers.

The original planning of the cooperative dairy factory movement must have been soundly based, as the past half century has seen only minor changes. The lack of comment in the pages of the "Journal" and the dearth of articles urging the need for the movement to be supported both betoken the ready acceptance of the principle of cooperative ownership. Such weaknesses as there were were rectified partly by internal reorganisations in the companies and on a broader basis by the strengthening of the Department's hands and the formation of such bodies as the New Zealand Dairy Produce Control Board—recorded in a 1923 issue of the "Journal"—and later the New Zealand Dairy Board in 1934.

Legislation such as the Dairy Produce Export Control Act in 1923, various milk and cream grading regulations, the dairy factory supply zoning regulations, and the regulations governing the registration of dairy factory managers all helped the companies to make cooperation a success.

The passing of the Cooperative Dairy Companies Act in 1949 enabled the loose ends of earlier days to be tied up. One of the main provisions of this Act was to enable the ownership of cooperative dairy factories to be vested in the hands of supplying producers only, dry shareholders (members holding shares but not supplying milk) being no longer permitted. One of the few weaknesses of earlier days was thus eliminated.

The principle of cooperative ownership has come to stay. Whether or not the next half century will show any change in this arrangement remains to be seen, but on the facts evident today any major change seems unlikely. The years may see a diminution in the number of cooperative dairy factories, but this will be only because the benefits of amalgamation of smaller units and the relatively lower costs of operating larger factories are today more clearly seen than when the "Journal" first appeared.

Changes in Dairy Factory Design and Operation

The dairy factories of 1910 were remarkably advanced for their time. They were not perhaps distinguished for their architecture—few rural buildings in New Zealand were in 1910—but they were equipped with machinery which was adequate for its purpose. Tinned copper was then the most advanced of the metals used for equipment and steam engines were the standard form of power supply. Dairy factories were cheap to construct and equip in those days and an early writer in the "Journal" remarked that a 100-ton butter factory should not cost more than £2,000 fully equipped and a 200-ton cheese factory, including a manager's house, between £1,500 and £1,650. Today one tends when estimating the cost of a new dairy factory to round figures out to to the nearest £5,000!

The products made in these factories were limited to butter and cheese, though the first steps toward diversification were to follow very shortly. During 1910, according to the "Journal", 380 creameries and cheese factories made 16,823 tons of butter and 17,019 tons of cheese. By 1959 these figures had grown to about 220,000 tons of butter, 85,000 tons of cheese, and 100,000 tons of other dairy products all produced in only 268 butter and cheese factories and 134 factories of other types. Moreover, today exports instead

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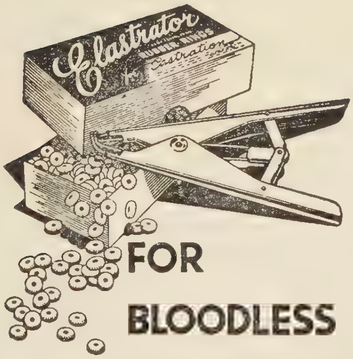

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The most noticeable feature of the past half century has undoubtedly been the extent of diversification adopted in the production of dairy products other than butter and Cheddar-type cheese. Casein was introduced during the 1910-11 season; lactose was first manufactured in 1913-14, rennet, first produced locally in 1916, was being made in sufficient quantity by 1929 to meet all New Zealand's needs; rindless cheese was first manufactured and exported in 1955, and lactalbumin was first offered commercially in 1956. Milk powder has made the greatest impact on the export market. In 1918 less than 2,000 tons of milk powder was being exported; by 1936 this amount had grown to 5,000 tons, by 1946 to 12,000 tons, and by 1959 the figure had reached 60,000 tons. Casein, not sold at all in 1910, was being exported at the rate of 27,000 tons a year by 1959.

Pasteurisation of Milk

Few changes have taken place in the basic principles of dairy products manufacture, most of the half century's changes having been in the equipment. The pasteurisation of milk for cheese and cream for butter—today universally accepted practice—was slowly being introduced by 1910. An article in the July issue of the "Journal" that year extolled the advantages of pasteurising cream for buttermaking, the author claiming that, if carried out in the right way, pasteurisation would always improve the quality of the butter. How right he has been proved many times over by the records and grading results of the Department.

Stainless steel has today displaced tinned copper in most dairy factories. Steam engines have given way to individual electric motors. The old churn and butterworking table, still in use when the first "Journal" appeared, was superseded by combined churns and butterworkers, and these in turn are now slowly giving way to impressive stainless steel rollerless churns. Similarly, the rotary flash pasteurisers of yesterday have been replaced by the vacuum pasteuriser for cream and the plate pasteuriser for cheese milk.

Milk testing methods have changed but little and the Babcock test is still the standard test in dairy factories for ascertaining the fat content of a supplier's milk or cream. The Department has, for more than the half century of the "Journal's" life, been insistent on seeing that dairy companies tested their suppliers' milk and cream fairly and an article in a 1928 issue of the "Journal" dealt with the check testing of milk and cream. This Department's check testing service had dated from before 1910, but the years saw a steady tightening by the Department of all aspects of milk and cream testing and grading.

DAIRY PRODUCE GRADING — 1910 and TODAY

Dairy produce grading was already well established in 1910, when the "Journal" started. A grading store of that period is shown above; below is a section of the Auckland dairy produce stores, in which 137,400 tons of butter and 11,900 tons of cheese were graded last season.

[*National Publicity*

When a system of compulsory differential payments according to quality was introduced in the 30s a similar supervisory and checking service was maintained by the Department. The absence of "Journal" articles in later years on the subject of testing and quality ascertainment only reflect the fact that the Department's role in the matter was universally accepted by the industry.

Grading of Dairy Produce

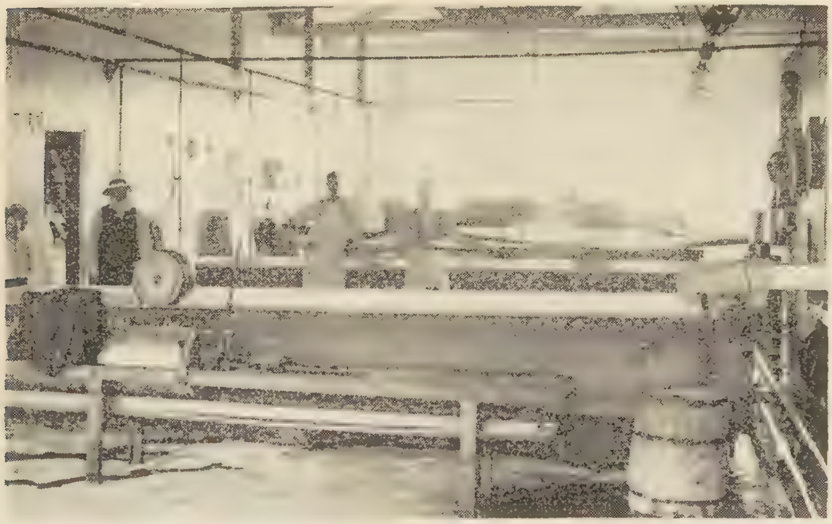
New Zealand was one of the first countries in the world to grade its dairy produce before shipping it overseas, the Dairy Industry Act of 1892 giving power to the Department to regulate the manufacture of butter and cheese for export by, among other things, requiring that all dairy produce be branded before export. The grading of butter and cheese thus started, quickly became an important part of the Department's work and subsequent legislation gave the Department adequate powers to see that New Zealand butter and cheese could safely be bought by buyers in distant markets.

By 1911 the principle of grading had been so well accepted that the Department decided to appoint a resident inspector of dairy products in London to judge the out-turn of New Zealand butter and cheese there and by so doing to ensure that grading standards in New Zealand were maintained in line with the market requirements of the country's principal customer.

References in the 1923 issues of the "Journal" to the Dairy Produce Ex-

EARLY DAIRY FACTORIES

← Ngaire butter factory, near Eltham, Taranaki.



← Cheese factory equipment as used about 1910.

← Separate churns and separate butterworkers were still popular in 1910.

port Control Act and to the regulation fees chargeable for grading and in a 1925 issue to the subject of uniformity in grading procedures all reflect the importance of dairy produce grading in the activities of the Department.

A "Journal" issue of 1927 recorded the introduction of butter and cheese grading regulations. The compulsory grading of milk powder by the Department was introduced in 1954 and of casein in 1955.

Half a Century of Marketing Changes

A London market report in the very first issue of the "Journal" in 1910 quoted details of the market for butter and cheese as:

> **Butter:** The market is quiet and prices slightly weaker. New Zealand choicest 107s., Danish 113s., Australian 103s., Siberian 101s. per hundredweight.
>
> **Cheese:** The market is dull. New Zealand finest 56s. per hundredweight.

Apart from the mention of a vanished source of butter this reference is interesting because of the contrast between the prices quoted and recent realisations: New Zealand butter 290s. and cheese 231s. per hundredweight.

The half century has, however, seen many changes in dairy products marketing other than those in prices. The industry of 1910 and the individual dairy companies which formed it played a more active role in selling than they do today. In 1910 the companies had themselves to find buyers; this they did by selling either through U.K. dairy produce importers or through dairy produce agencies.

A company had to face the difficult choice of selling at the agent's price or else of selling on consignment. If it chose the former course, it could feel that at least it had secured its income for the season. If the market softened, the directors had made a good bargain and could afford to look superciliously at the neighbouring factory's poor return from having sold on consignment or on a weak market. If, on the other hand, the company sold on consignment, banking on a buoyant market, and found

MODERN DAIRY FACTORY

A contrast to the old factories illustrated on the opposite page: The Kerepehi milk powder factory of the New Zealand Co-operative Dairy Company.

[*Lesnie photo.*

that the market had fallen away, it could do little at the end of the season but rue its judgment and try to hold the loyalty of its shareholders against the pull of the neighbouring factory which had wisely accepted the agents' firm bid for the season's output. The choice was indeed a difficult one and was made no easier by the distance separating the dairy companies from their principal market.

As cooperatives the dairy companies early desired to strengthen their position by extending the cooperative principle to marketing. The desire was given initial effect in the 1920-21 season when, following a recommendation made at the 1918 conference of the National Dairy Association, it was decided to organise the dairy factories in New Zealand into a joint marketing organisation with a major cooperative wholesaling concern in England.

Later developments led to the formation of further marketing systems on the same voluntary lines, but these all gave way in 1936 to the system envisaged by the Primary Products Marketing Act the State-guaranteed system of payment to producers of butter and cheese. Under this arrangement the Government became the first purchaser of all butter and cheese produced in New Zealand for export and guaranteed the producer a fixed f.o.b. price per pound of butter or cheese for the whole season's output. The Government itself undertook to market all the produce so bought. The price for butter was 13.040d. and for cheese 15.050d.

A further step forward from the producers' point of view was the establishment in 1947 of the New Zealand Dairy Products Marketing Commission. This Commission was formed to take over the dairy produce marketing responsibilities handled since 1936 by a Government marketing department.

The Commission over the years has accepted its responsibilities enthusiastically and exercised its selling functions energetically. In the early stages and up to 1954 it continued to honour the bulk-purchase contract its predecessor (the Government) had entered into with the U.K. during the war. Even during that period, however, it had begun to explore new markets and this foresight was rewarded when open-market trading was restored. The Commission thus became free to supply markets other than the United Kingdom with all the dairy products available.

In the first market reports published in the "Journal" in 1910 the only market mentioned was the United Kingdom. Today New Zealand through the Commission sells butter, cheese, and a long list of other dairy products to over 60 countries.

Market Milk

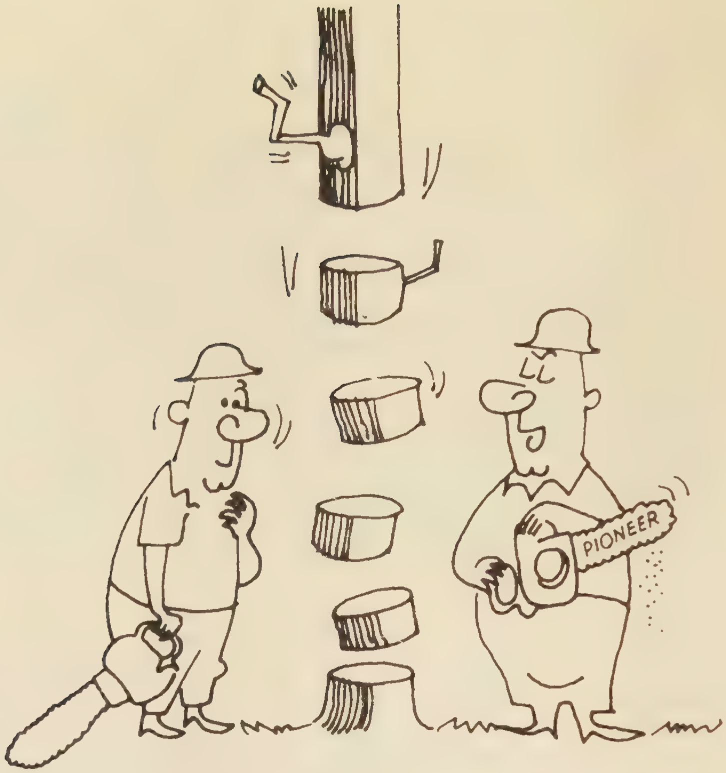
The market milk section of the dairy industry did not impinge on the activities of the Dairy Division until quite late in the half-century under review. This was partly due to the smaller size and relative unimportance of the market milk industry and partly to the fact that the manufacturing side of the industry contributed largely to the country's overseas income.

The Department's responsibilities in the market milk field were crystallised when the findings of the Milk Commission in 1943 resulted in the passing of the Milk Act in 1944 and the formation of the Milk Marketing Division of the Marketing Department the same year. One of the early results of the Division's decision to reorganise the market milk industry on a more satisfactory basis was that the Department, through the Dairy Division, had to supply much of the technical knowledge needed to effect this reorganisation. The Department, therefore, entered the market milk field in 1947 and proceeded to help at all levels in the tasks facing the industry.

Its main concern at first was with the building of new milk treatment stations and rebuilding of old ones. Its collaboration with the Milk Marketing Division soon resulted in a major improvement of the country's existing milk plants and in the provision of new plants where none had previously existed.

The supervision of town milk supply sheds had for many years been a function of the Department through its Livestock Division. By the early 1950s it was being increasingly felt, however, that more effective assistance could be rendered to the industry by the coordination within one Division of all the activities connected with the supervision of the market milk industry. It was also felt that the position whereby factory supply sheds were supervised by one Division and town supply sheds by another was somewhat anomalous. Supervision of town supply sheds was therefore transferred from the Livestock Division to the Dairy Division in 1952.

Administration of the market milk industry had for several years since 1943 been under the control of the



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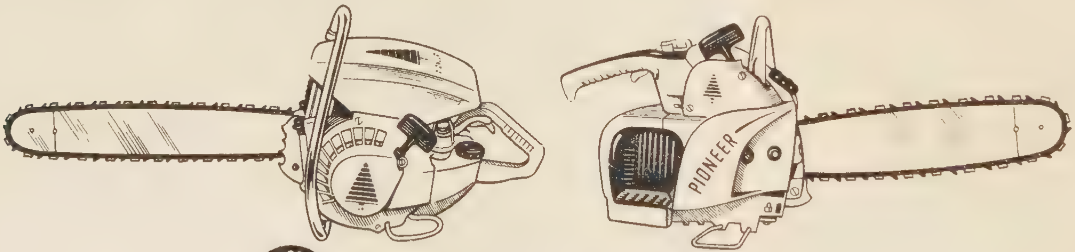

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One of the new milk treatment stations opened since the building and replacement programme was begun in 1947; the Auckland station at Penrose, opened in 1952.

Marketing Division which was assisted in its work both by the Dairy Division of the Department of Agriculture and by an advisory body known as the Central Milk Council. In 1951 an amending Milk Act strengthened the role of the Council and in 1953 a further amending Act reorganised the Council, establishing it as the New Zealand Milk Board and giving it wide administrative powers. The Milk Board, as operating today, maintains a financial oversight over the operations of the industry and exercises the functions previously performed by the Marketing Division. The Department has, over the years, continued to work closely with all these bodies.

Several articles on the market milk industry have appeared in the "Journal" since 1943, when the first decision was taken to reorganise the industry. It is, perhaps, appropriate that this jubilee supplement of the "Journal" should record the coming of age, as far as the capacity and general performance of the industry is concerned, of this section of the dairy industry which has so lately, but effectively, come under the supervisory control of the Department.

Milking Sheds 1910-1960

VIEWS and recommendations of officers of the Dairy Division recorded in the "Journal" during the last 50 years have considerably influenced progress in milking shed design and practices. The aim throughout the years has remained constant: Plant and conditions which could be worked efficiently without any sacrifice in standards of hygiene.

CHANGES in milking shed design have of necessity been brought about by developments such as the more general use of concrete as a building material, the introduction of the milking machine and attendant cleaning problems, and the general use of electricity.

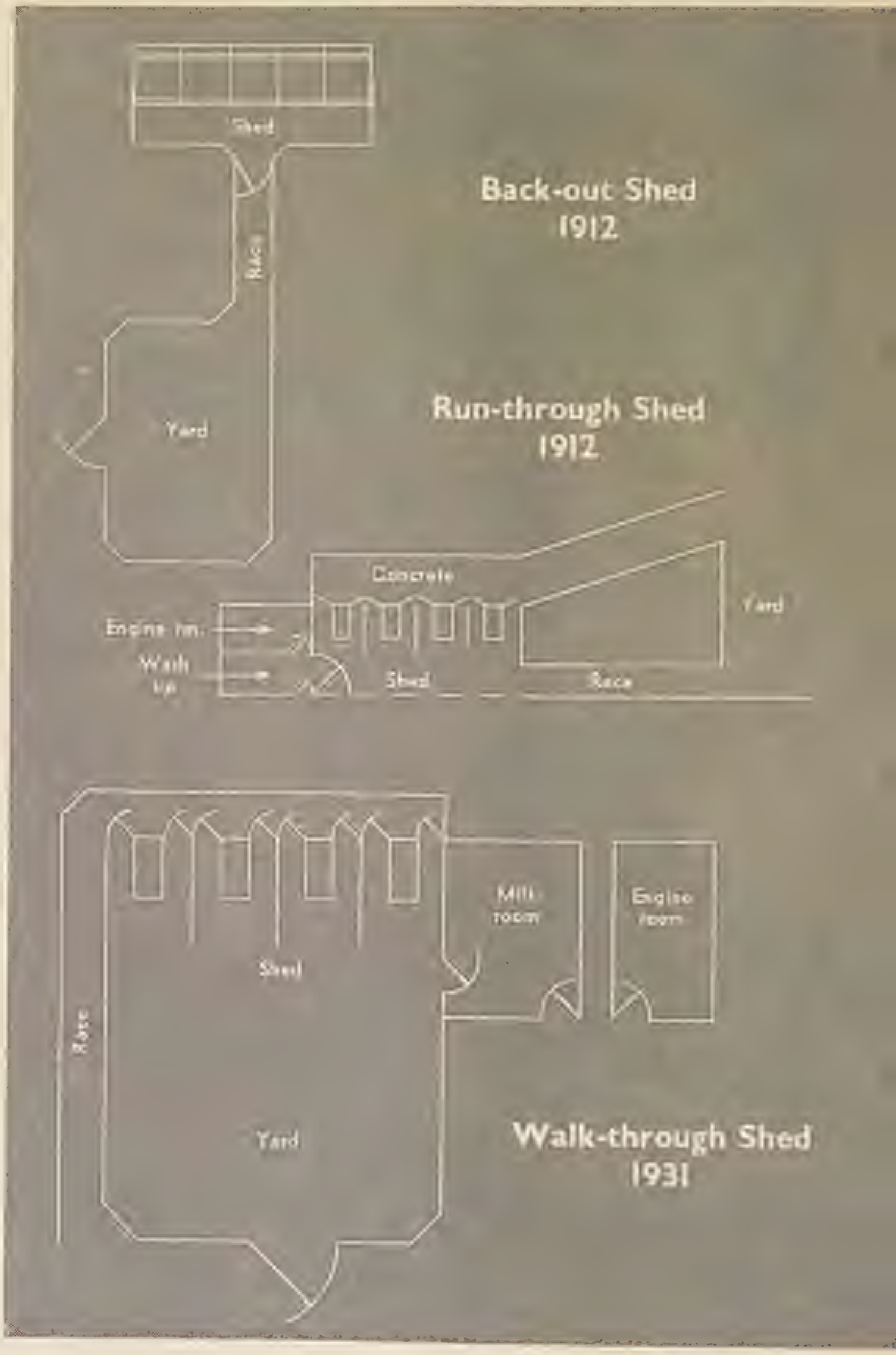
Before 1910 a large number of small milk suppliers delivered to local creameries and there was little, if any, supervision of conditions at farm dairies. Defects in quality were apparent in much of the produce received at these creameries and the industry requested the assistance of the Dairy Division. With the cooperation of farmers improvements were made to premises and research conducted into the care and handling of dairy produce and milking machines.

Many milking sheds were very crude, being built of split slabs or corrugated iron with earth or wooden floors; the main concern appears to have been protection of the milker from the elements rather than hygienic milk production. Preparation of basic plans for buildings which would greatly improve conditions was essential, and copies of plans of sheds recommended by the Dairy-produce Division appeared in the "Journal" for August and September 1912. They were for a back-out, hand milking type of dairy and an extension of it for a walk-through dairy using machines. Plans included a concrete floor in the milking shed and milk collection room and 6 in. dwarf walls, but no indication was given that the yards should be concreted.

An engine room and wash-up room were shown and the procedure at that time was to install machinery associated with milking in the engine room. The motive power was usually a petrol engine, but sometimes power was supplied by small steam units. Home separation was in its infancy and most of the dairies were on whole milk supply. The provision of a wash-up room was necessary, as milking machines were hand washed and brushed daily. (Recommended procedure was described in the June 1912 "Journal".)

Minor alterations and improvements were effected to the shed plans, but generally conditions remained unsatisfactory, particularly surroundings. In 1926 it was found necessary to insist on yards being concreted and on the provision of either a draught-proof partition or an air space of 2 ft between the milking shed and releaser room.

DEVELOPMENT OF DAIRY SHED PLANS



When electric power for operating milking machines became available further changes in shed design were effected, the draught-proof partition being dispensed with and 4 ft concrete walls adopted. With improved transport and supplies of aggregate and cement it was possible to improve sanitation by requiring that holding yards at dairies should be concreted; this was made compulsory in 1938. As these improvements developed, the quality of dairy produce improved and the work associated with the milking of cows became more congenial.

The national Farm Dairy Instruction Service was introduced in 1938 and articles appearing in the "Journal" the following year emphasised the importance of constructing milking sheds incorporating all features necessary to give the best quality produce and most efficient working conditions.

Walk-through Shed

With the general use of milking machines the walk-through type of milking shed as described in the June 1939 "Journal" was favoured. This type of construction, with variations to suit changed conditions, was basically that recommended in 1912. More emphasis was given to the selection of convenient sites which would give more or less permanently good surroundings (the "Journal," July 1959).

Internal-race Shed

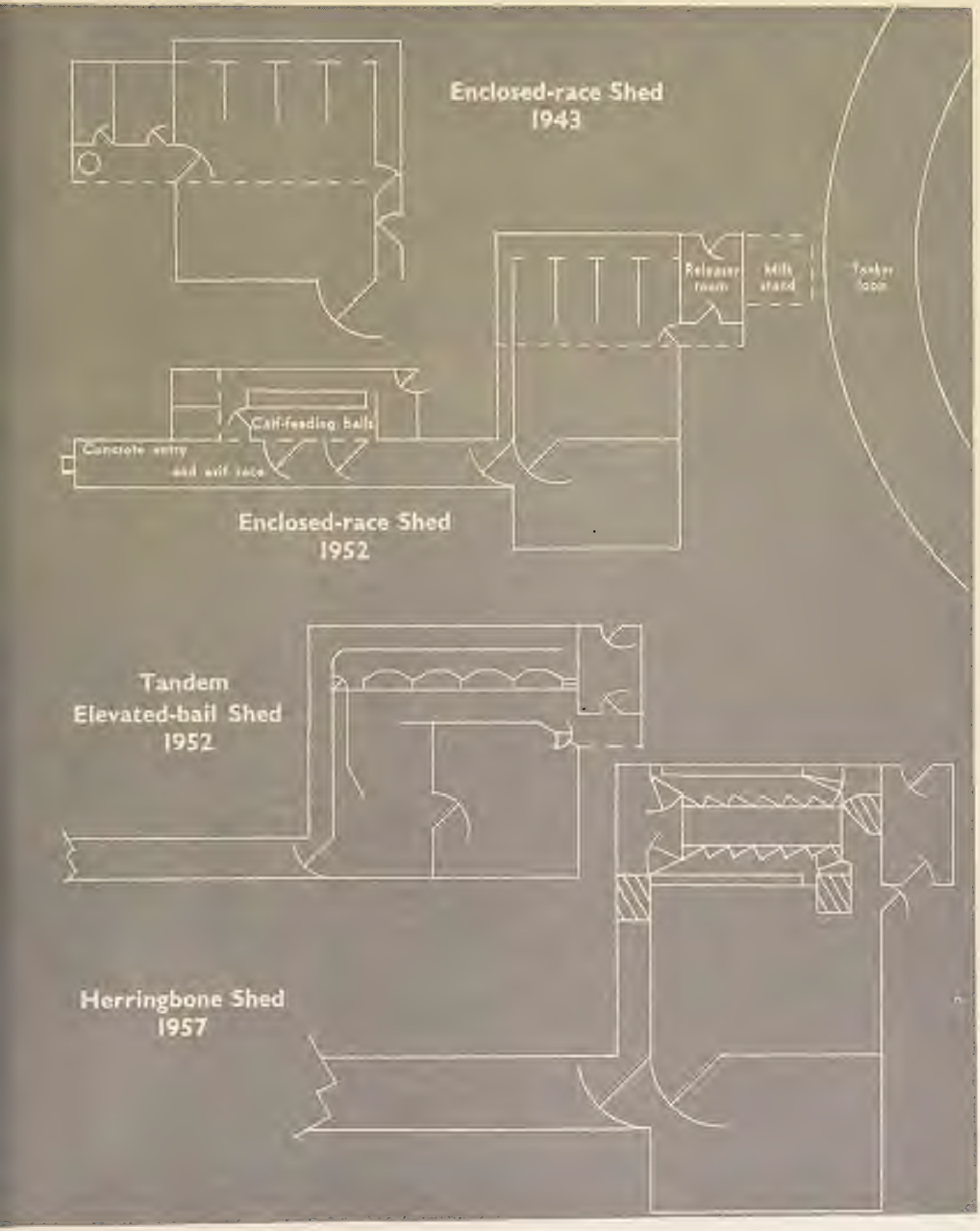
The introduction of the internal-race milking shed about this time and the development of this type were definite advances. Unsatisfactory features in the walk-through type, such as cold working conditions in inclement weather and poor control of stock generally, were eliminated. The design made possible the cleaning of the exit, which with the walk-through shed tended to be neglected, in conjunction with the ordinary shed cleaning. A plan of an internal race shed was published in the "Journal" in April 1943.

A considerable advance in improving sanitation was the introduction of piping (in place of timber) for bail construction. Supplies of suitable piping were short during and soon after the Second World War, and even by 1950 an article on shed design in pointing out the advantages of piping mentioned that it was not permissible to use galvanised piping (the "Journal", April 1950).

"Stoopless" Milking

A further development was the introduction of elevated-bail milking, known as the tandem type of construction (described and illustrated in detail in the August 1952 "Journal"). Designed with a view to eliminating stooping during the washing of cows and changing of cups, this type of shed maintained the features necessary for good shed technique and sanitation.

With modifications this type may become accepted where stoopless milking is desired. Interest in elevated-bail milking stimulated by the introduction of the tandem system resulted almost immediately in the development of the herringbone system, mentioned in the September "Journal" 1954 (page 218). This type of dairy may also with modifications develop and become more generally adopted.


Enclosed-race Shed
1943
Releaser room
Milk stand
Tanker loop
Calf-feeding bails
Concrete entry and exit race
Enclosed-race Shed
1952
Tandem
Elevated-bail Shed
1952
Herringbone Shed
1957

Today greater interest in the planning and construction of milking sheds is being displayed by dairymen generally. Though great progress has been made during the 50 years that the "Journal" has been published, and it is a far cry from the hand-milking dairy with its wooden floors and crude construction to the modern internal-race or elevated-bail shed, improvements which will further enhance the quality of dairy produce are likely to be made.

Use of Concrete

The use of concrete in the milking shed was first recommended by the Dairy Division in plans prepared in 1912, but unfortunately transport difficulties, scarcity of suitable aggregate in many localities, and the high cost of cement did not encourage its general use. However, as these difficulties were overcome farmers were quick to realise its advantages. In fact it could be said that in many of the sheds erected between 1920 and 1940 much waste was evident, as yards were too large for requirements and outlets from milking sheds were often extended in concrete very haphazardly.

The 1912 plan shows a 6 in. dwarf wall to support the building. This was found to be too low and in 1926 dwarf walls 2 ft high were recommended. However, because of deterioration of the upper structure where it was affixed to the dwarf wall, it was agreed that the height of concrete walls should be extended to 4 ft, thus obviating substantial renovation at frequent intervals.

The judicious use of concrete, which is comparatively cheap, has resulted in improvements to premises and surroundings which, besides greatly improving working conditions, has considerably helped to maintain the quality of our dairy produce.

Introduction of Electric Power

At first most milking machines were powered by petrol engines, though a few farmers had small steam plants. The advantages and possibilities of electricity were appraised by L. Birks, Chief Electrical Engineer, Public Works Department, in the August 1921 "Journal".

". . . it is becoming clear," he wrote, "that the milking machine motor will be the main justification for a large proportion of the country reticulation. A revenue of £24 to £30 is available from the average dairy farm for the milking machine alone . . . and when the line is once run to the farm all kinds of other uses are found for electricity—lighting, ironing, cooking, heating, and power generally." Present extensive use of electricity on farms has proved Birks to have underestimated the possibilities if anything.

Electricity at £21 per annum for the average farm producing up to 7,000 lb of butterfat compared very favourably with petrol at £1 to 30s. an eight-gallon case, but much of the equipment was badly installed and breakdowns were frequent. Long drives to shafts and countershafts created hazards and wasted power.

The fall in dairy prices in the early 1920s tended to delay the extension of electricity reticulation in rural areas, but steady progress was being made and some suggested changes in installation which would reduce costs were referred to by Birks in another article in the "Journal" in March 1923.

Water Heating

With the improvements being made to dairy farms much of the land was cleared of wood which had been readily available for fuel-burning heaters from locations handy to the dairy. This increased farmers' interest in the alternative of electric water heating. By 1935 the changeover to electric water heating had become so extensive that it became necessary to consider suitable requirements at milking sheds. The decisions reached were featured in an article on milking shed equipment in the September 1939 issue of the "Journal". The sizes of equipment considered necessary for the adequate supply of boiling water at milking sheds for the effective cleaning of the equipment were quoted.

Since then improvements to the design of electric hot water cylinders have been made which improve their efficiency and eliminate much of the waste of electric current.

Electricity has played a major part in the development of the dairy industry in New Zealand. Today compact installations of milking machines can be made, so reducing construction costs and providing sheds which can be operated efficiently.

Cleaning of Milking Machines

Overseas practices were first adopted for cleaning of milking machines—soaking and brushing, a time-consuming method that caused rapid deterioration of the rubber. Investigations made by Dairy Division officers revealed many unsatisfactory and insanitary milking machines, and attention to this was drawn in the "Journal". The boiling water and caustic soda method was first recommended in an article in 1925.

Before this, hot water for cleaning dairy equipment was obtained from the cooling water tanks fitted to internal combustion engines or was carted by suppliers from creameries or skimming stations. In both cases of course it was almost cold when used for cleaning machines and was quite ineffective.

The installation a little later of fuel heaters, principally wood-burning coppers, improved hot water supplies, but the greatest improvement came with the development of hydro-electric power and the installation of electric hot water cylinders. The first units were small (about 10 gallons capacity) with small elements that were more or less adequate for the type of equipment then installed at dairies.

Many farmers who, without guidance, installed equipment they considered might suit their particular circumstances found that as milking units became larger, the hot water plant was too small for requirements. Close investigation into the overall use of electricity as a medium of supplying hot water in the dairy resulted in firm recommendations being made in 1935 that were later incorporated in a regulation.

Improved Techniques

During the same period much research was carried out into detergents and methods of cleaning, and the caustic soda and boiling water method was almost universally adopted with greatly improved results. Detailed recommendations for keeping milking shed equipment clean were given in a series of "Journal" articles in 1939. The construction of milking machines with components which could be cleaned readily was made compulsory by regulation in 1938.

The importance of sanitation at the milking shed has constantly been emphasised in the "Journal" by Departmental officers and much has been done in this field to assist the dairy farmer. The design of milking machines and components is watched to ensure that equipment difficult to clean is not installed. Installations are required by regulation to comply with requirements aimed at improving their efficiency, and today installations are compact yet easily accessible for quick dismantling and cleaning.

A recent development recorded in the "Journal" is recycle washing, which may become standard practice as it becomes better known. However, this modern technique depends as much for efficiency on regular use of boiling water and a good detergent as does the conventional method developed and used over the years.

LIVESTOCK

FROM 1910 to the present day there has been steady development in the livestock industry following the outstanding discoveries of research workers which opened the road to production goals undreamed of by the pioneering generations of farmers. Under the spur of still more modern techniques developed at major research stations and applied by advisory workers in the field, the annual yield of animal products from New Zealand farms is still increasing so that now the problem has become one of marketing with, however, the comforting thought that improvements in animal husbandry and disease control can now lead to reduction in costs, which is all important in competitive selling on the world's markets.

PROMINENT among the changes which occurred during the period under discussion, were:

Stabilisation of breeds of cattle and sheep, with specialised breeds taking the place of dual-purpose animals.

Recognition of the importance of trace elements and the development of practical methods of overcoming deficiencies of these substances.

Control of disease in livestock by vaccines and by improved remedies, culminating in the 1940s with the appearance of the first of the antibiotics, the use of penicillin to control mastitis in dairy cattle.

Parallel with these developments improved methods of feeding livestock became established with the abandoning of the old "feast and famine" method of farming in the more progressive districts. Though there are still some areas in which dairy cattle are turned out to fend for themselves during winter, most farmers now pay special attention to fodder conservation and to all-the-year-round management of pasture. They realise that only by so doing will their stock grow, produce, and reproduce satisfactorily.

Very Few Outbreaks of Serious Disease

Between 1910 and 1960 there have been very few outbreaks of diseases which are recognised overseas as major problems of animal husbandry.

Anthrax has occurred on a very few occasions.

Swine fever has been known twice, indicating the very real need for the Department's rigid control of garbage fed to pigs.

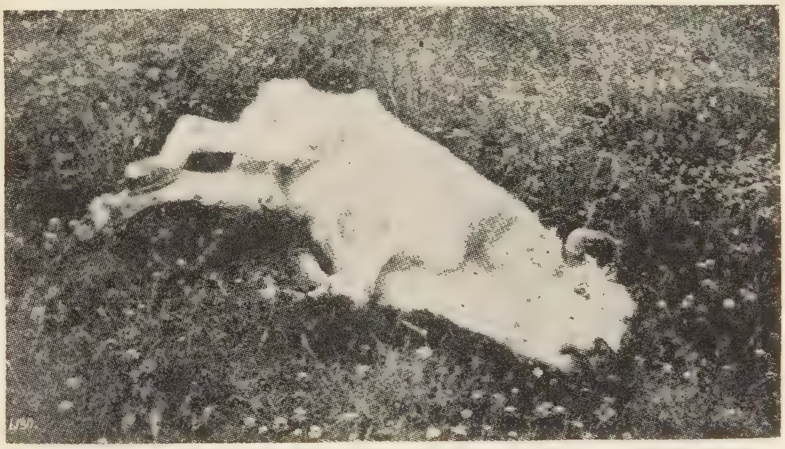
Foot and mouth disease and rinderpest have never been introduced into this country.

Throughout the years the Department has relied on importation restricted to approved countries rather than on quarantine to preserve New Zealand's immunity. Though this policy has sometimes appeared irksome, it has been amply justified by results and the livestock industry of this country has developed to a most satisfactory state without being exposed to the dangers accepted as part of farming in many countries.

Conquest of Bush Sickness

IN such a period of major development it will be possible to select only a few of the most outstanding achievements to indicate progress, which is still continuing. Typical of such success was the conquest of bush sickness, a name which is rarely heard today, though in the 1920s it signified a mystifying deficiency; it took out of production vast areas of easily worked country on which stock simply would not thrive for any length of time.

In November 1911, B. C. Aston (Agricultural Chemist, Dominion Chemical Laboratory) wrote a comprehensive article on bush sickness with a special footnote: "The term bush sickness is quite a misnomer. The condition may develop on land that has been cleared of bush or forest for over 20 years."



Bush sick beast dying in a bed of clover. (Reproduced from the "Journal", November 1911.)

Aston stated definitely that "evidence adduced by veterinary officers of the Department over the period of 14 years that they have been cognisant of the matter goes to show that the condition in stock known locally as 'bush disease' or 'bush sickness' which occurs in the Rotorua, Matamata, and Tauranga Counties (longitude 176° E., latitude 38° S.) is not a disease in the proper sense of the term, but a physiological condition resulting either from: (a) a food supply wanting or deficient in some essential nutrient, which therefore results practically in starvation; or (b) a food supply containing naturally or adventitiously (1) some toxic compound, or (2) some normal constituent present in abnormal quantity, resulting in chronic poisoning."

At this stage it had been shown that animals removed from the affected

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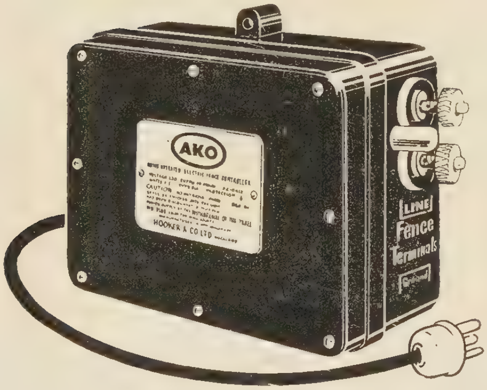

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areas began to recover as soon as they were placed on sound country. They showed no known bacterial infection and no transmitted disease. Aston therefore asked:

"1. Is there any poisoning present in the animal, in the food, or in the soil?

"2. Whether such poisons (if present) are there in amounts which would be injurious under the conditions prevailing on the 'sick' country?

"3. Is there a want of balance in the food constituents, organic or inorganic, which would result in the condition complained of?"

Gilruth (the first Chief Veterinarian of the Department) had earlier described the condition as one of "progressive anaemia" so that the stage was set for the chemist to determine the cause.

In his article Aston reviewed known deficiencies and also discusses the type of soil known to be bush sick: "They are invariably soils consisting largely of pumice and other ejectamenta comparatively recently blown out of the bowels of the earth and scattered by the wind over a large area . . ."

Need for Patience

Later Aston made a remark which is equally applicable today:

> **In investigating an obscure disease one must not expect immediate results or be impatient if some definite answer is not at once forthcoming from experiments.**

He went on: "In a case such as this, where the onset of the ailment is so long delayed, taking perhaps months, it is only reasonable to suppose that the abnormality in conditions which is the cause is not very greatly removed from absolute normality, and it is this fact which inspires most hope that a practicable remedy may be found—i.e., by altering the animal's diet in some way, the cause of wasting may be counteracted."

How right Aston was. Not until 30 years later was the cause of bush sickness revealed as a result of work done in Australia on a similar condition by Filmer* and Underwood.

The research of Filmer and many other scientists into cobalt deficiency in New Zealand vindicates the faith that Aston, pioneer in deficiency diseases, held in 1910. During the years of trial and error hundreds of experiments were carried out to answer the questions voiced by Aston:

> *Why should ruminants be affected and non-ruminants always remain perfectly healthy?*
>
> *Would it be fairer to attribute the sickness to unsatisfactory farming than to any defect of the soil or food?*

▲ Bush sick cow before going on to topdressed pasture.

▼ The same cow after grazing on topdressed land and being treated with syrup of iron phosphate.

[*The "Journal", February 1914*

Experimental work had been forecast in the November 1910 "Journal", when it was mentioned that five experimental paddocks had been selected and fenced in various parts of the bush sick area. It was intended to treat these paddocks with various dressings and to observe the results.

In August 1912 C. J. Reakes* discussed the progress of investigations into bush sickness as he had decided to call the trouble. A veterinarian,

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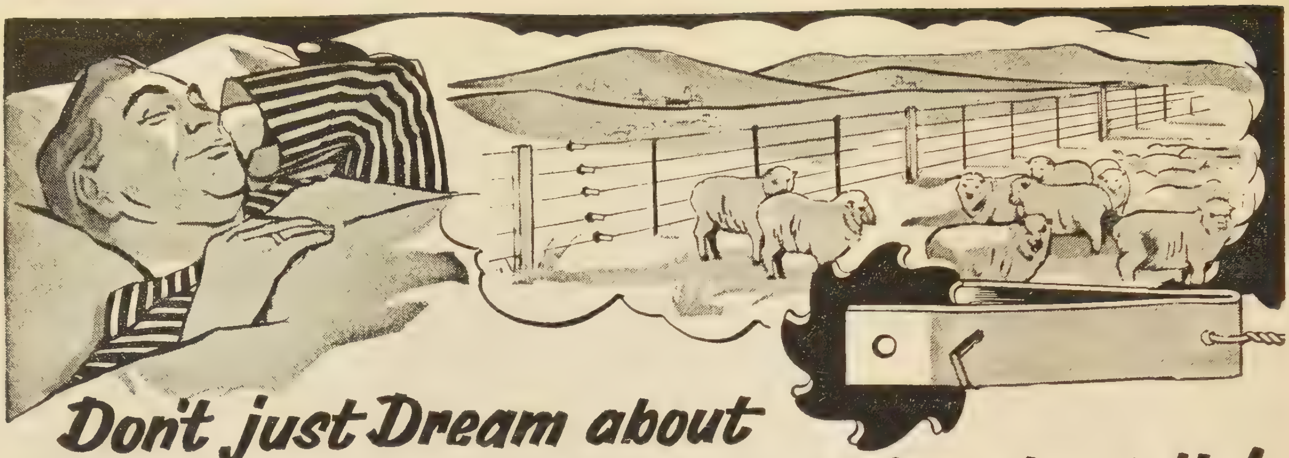
* Later, Director, Animal Research Division, New Zealand Department of Agriculture.

* Chief Veterinarian; Director-General 1918-36.



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J. Kerrigan, had been stationed at Rotorua and a great deal of experimental work was done both in the field and in the laboratory. Reakes started the classical "mistake" at this time, when he referred to the fact that

> . . . a deficiency of available iron is probably responsible for the trouble, and though it would be premature yet to affirm certainty on this point, it certainly looks most promising. In any case the field of investigation has now been narrowed down considerably and I consider the outlook particularly hopeful.

It was noteworthy that no mention was made in this report of the type of topdressing applied, though it was stated that three young steers had been kept healthy for 15 months when "controls" run on similar but untreated paddocks had long since died.

In April 1913 Reakes again reported on the experiment and mentioned that the three steers were still doing well after two years on plots treated with 7 cwt of superphosphate per acre. Two other steers had remained healthy for two years on paddocks treated with Malden Island guano at 10 cwt per acre. A ewe kept on the area for 16 months was also healthy.

Early Optimism

At this stage Reakes was most hopeful and set out the results of the experiment in detail in the June 1913 issue. Lime apparently had no beneficial effect, but superphosphate and iron sulphate showed some promise at Mamaku. Reakes summed up:

> A study of these experiments . . . indicates that the best results were obtained, in the case of cattle, with soil dressings of (1) superphosphate, (2) sulphate of iron, (3) blood and bone (with luxuriant herbage ploughed in), (4) guano (with luxuriant herbage ploughed in); in the case of sheep, with (1) sulphate of iron, (2) basic slag, (3) superphosphate.

At that stage it was not appreciated apparently that young sheep are most affected by bush sickness (cobalt deficiency). In the same article, however, are words which should have given the key:

> The good results obtained with sheep from sulphate of iron used as a topdressing were rather seriously discounted by a later experiment conducted at Te Pu, where ewes placed sometime before lambing in paddocks topdressed with this, died a few months later, together with their lambs. . .

The sheep used in this trial were from land adjacent to bush sick country, which was probably what we now know as marginal cobalt deficient country.

By 1914 the experimental farm at Mamaku had become well established, 160 acres being in use. Drenching daily with syrup of iron phosphate gave spectacular results (see illustration on page 65). It was not recommended, however, that this treatment be used; even then emphasis was placed on methods of topdressing to supply the mysterious substance lacking in the soil. It was now firmly decided that heavy dressings of superphosphate would prevent the condition and that iron deficiency was a basic cause.

In 1915 there is the first mention of a preventive lick which was used in experiments at Mamaku. The ingredients given for the lick were "perchloride of iron, common salt, sulphate of calcium, and hydrate of calcium".

Research was now concentrated on the best method of supplying readily available iron and the right type of topdressing to use. In 1916 the Department would not recommend dairying on bush sick country, though at Mamaku such farming had been carried on successfully, and during the next few years it became evident that topdressing with superphosphate alone was not sufficient to prevent bush sickness. Experimental work with iron compounds went on steadily and in April 1919 Reakes and Aston discussed the use of a combined iron and ammonium citrate known as ferri-ammonium citrate, which was quicker in its results than the syrup of iron phosphate. Aston was by this time calling the disease "iron starvation", and in a long article in the April 1929 "Journal" there is the first mention of dosing with ground carbonate of iron.

Topdressing Helps

Superphosphate and basic slag topdressings had certainly proved the usefulness of phosphatic fertiliser, but the iron-lack theory was now so firmly established that there is no mention in any of the numerous articles of any other possible deficiency. The quantities of the ferri-ammonium citrate used were growing fast, as it was considered that 1 lb of citrate would keep a cattle beast healthy for a year.

In the early 1930s ragwort became a menace on the pumice country and combined with bush sickness against the settlers. It is interesting to note Aston's comment in July 1930 on ragwort-eradication experiments by C. R. Taylor (now Instructor in Agriculture, Rotorua) with various chemical compounds, including sodium chlorate and mixtures:

> . . . these provide evidence that ragwort, which is considered locally a great danger and cumulative with bush sickness in preventing the settlement of pumice lands, need no longer be feared.

Aston's Prescience

This article of Aston's is of particular significance because in it he disposes of the various theories proposed during the year by what he called "various experts". These theories varied from calcium deficiency in the soil to poisonous elements in the soil or pastures. Aston clearly linked the deficiency present in bush sick country with that seen in sand dune soil type in New Zealand and Tasmania, in the gravel country in Nelson, the volcanic ash in Kenya, and the Cheviot hills in Scotland. He believed firmly that the deficiency was a simple one and that it was associated with open-textured soils. **In this he was correct.**

All energies of the research worker were now devoted to obtaining the most effective and cheapest form of iron. At this stage limonite ore was being obtained from Whangarei. It was the softest crude ore available and easily powdered. The mineral was provided as licks, as it has no objectionable taste, which had made the citrate hard to administer. There was now no attempt to use a manurial mixture containing iron, as the licks were proving satisfactory.

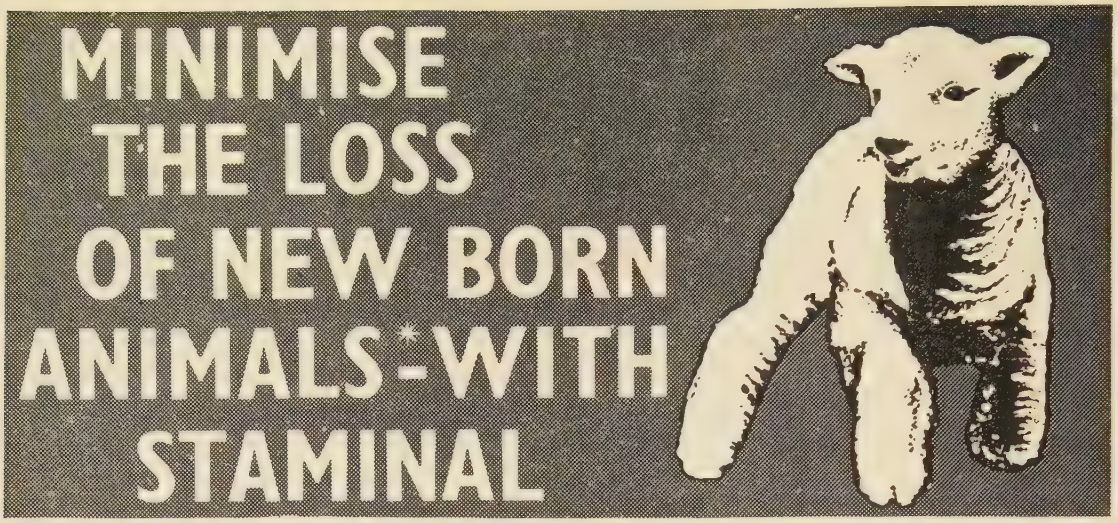
Cobalt Cure

In 1935, however, following the publication of Filmer and Underwood's work in Australia, interest was focused on cobalt. These authors had claimed that **iron free** extract of limonite cured enzootic marasmus in Western Australia; this disease was the same as bush sickness. Work done here by Grimmett and Shorland, however, was less conclusive, but the first experiments were small. Attempts were made to have selected farmers use cobalt drenches, but Hopkirk in the June 1937 "Journal" complained:

> Farmers in all areas where bush sickness was known to exist in cattle or sheep had become accustomed to feeding out limonite-salt licks, and on this account were rather loath to undertake the additional work which a drenching experiment would entail.

Experiments were started at Mamaku and Arohena, and results showed that cobalt did prevent bush sickness if given regularly once or twice a week. Hopkirk concludes:

> . . . although drenching with cobalt has been tried experimentally, it is not a practical method of control of bush sickness, as the labour involved is irksome and impossible when numbers of sheep have to be kept in health. The training of sheep and cattle to take limonite licks of high cobalt content is, as yet, the only practical means of controlling the mortality.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The "as yet" was highly significant, because Cawthron Institute soon proved that cobalt was readily taken up by pastures. C. R. Taylor in an article in the September 1938 issue gave this conclusion:

> The administration of cobalt to stock through the pastures by topdressing with cobaltised superphosphate is an effective and economic means of combating bush sickness in those areas where topdressing is applied annually as a routine practice.

A most satisfactory result was thus achieved after almost 30 years of continuous investigation. Much remained to be done, however, to determine the most suitable amounts of cobalt to use and the best time to apply the dressings, but the main battle was over. Bush sickness was no longer a serious disease where topdressing could be applied.

However, as at that time topdressing was not always practicable and as cobalt was scarce during the war, further work was done on drenching trials, and in October 1941 Filmer commented:

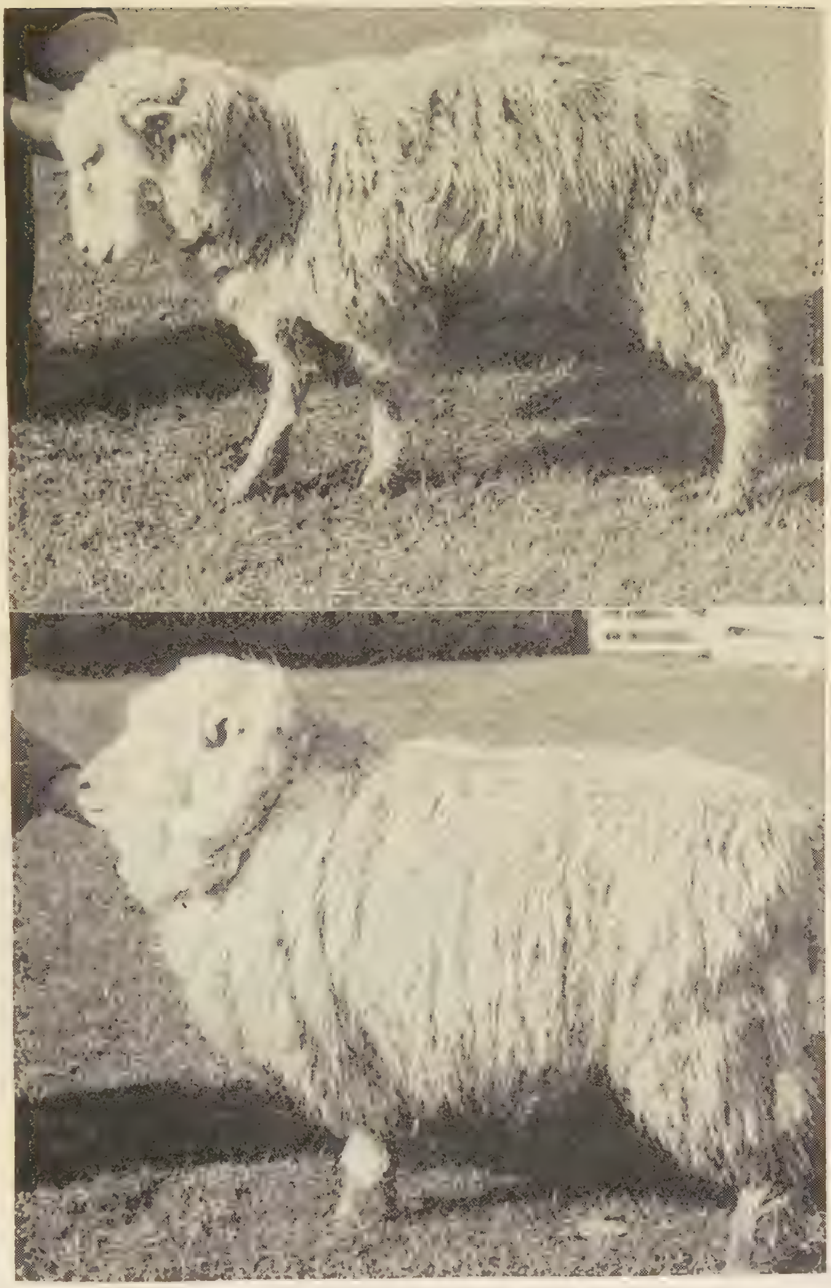
> Drenching at monthly intervals with very large doses of cobalt will keep ewes and lambs alive on bush sick country and will even cure bush sickness.

Aerial Application

Licks were also effective, but the best method of supplying cobalt was through the pastures. In the November 1947 "Journal" Andrews and Prichard* showed that applying cobalt **from the air** was a practical proposition. In this work a solution of cobalt sulphate was used, but this meant that large quantities of water had to be carried, which could be difficult in hill country. By 1950, however, aerial topdressing was an accomplished fact and the problem of applying cobaltised superphosphate to hilly country had been solved; 1 cwt of cobaltised superphosphate mixture containing 6 lb of cobalt sulphate to the ton was shown to be a sufficient annual dressing.

There remained the puzzling fact that only ruminants were affected by cobalt deficiency, but this was solved during 1948. Andrews in a comprehensive article in the March 1956 "Journal" stated:

> . . . British and American workers isolated a new growth factor which they called vitamin B_{12}, and found it contained cobalt. All higher animals need the vitamin, cattle and sheep apparently requiring more than do the other animals. In cattle and sheep vitamin B_{12} is elaborated in the rumen or paunch by microbes. For this purpose they use the cobalt naturally contained in feed. If cobalt intake is lower than normal, production of vitamin B_{12} is restricted and unthriftiness results.



Marginal cobalt deficiency affects mainly the rearing of young sheep. These lambs were from the same flock on marginally cobalt-deficient land, but the upper one was untreated, whereas the lower one received weekly doses of cobalt.

Marginal Deficiency

The problem of acute cobalt deficiency had now become merely historically important; only areas in which the soil is marginally deficient remain a problem to this day. It affects chiefly the rearing of young sheep. Calves are not nearly so susceptible. As Andrews put it:

> There are, however, areas where the cobalt content of soils is only mildly to moderately deficient. Still other soils have been tentatively described as marginal or suspected cobalt deficient. Within the areas represented by these two groups mature cattle and for the most part calves and mature sheep remain in

---

* E. D. Andrews, Wallaceville Animal Research Station, and A. M. Prichard, Chief Pilot, Aerodromes Services, Public Works Department, who made the first experimental flights in aerial farming operations.

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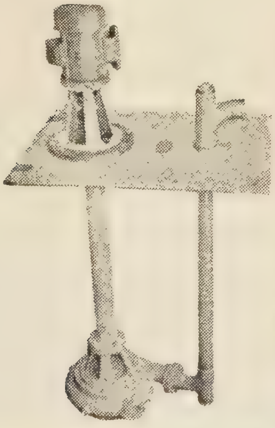

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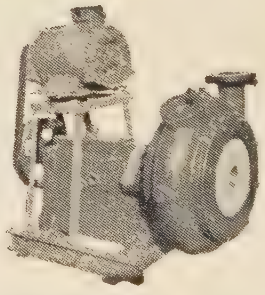

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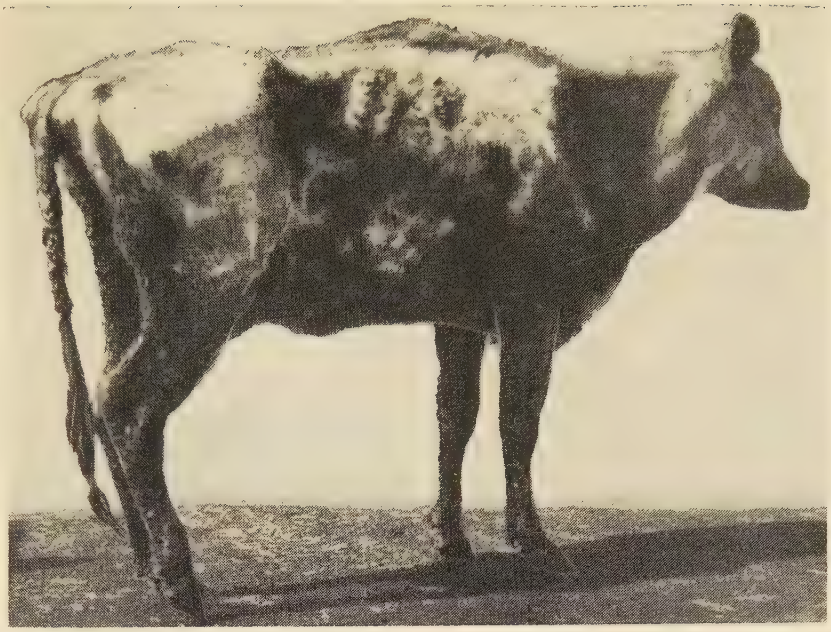
apparent good health, but young growing sheep can become affected to a greater or less degree. . . Unthriftiness usually appears between the third and sixth months. . . .

A map in the article referred to indicates by shading the cobalt status of New Zealand soils. This, of course, gives the broad picture only and is intended as a guide. The article stresses that if cobalt deficiency is suspected the most conclusive method of diagnosing it is to assess the response of animals to supplements of cobalt administered by mouth.

Trace element deficiencies are often very complex. In recent years cobalt, copper, molybdenum, and now selenium have been involved. Sometimes two or more deficiencies can occur, but the story of bush sickness illustrates very definitely the persistent and patient work necessary to produce a satisfactory solution.



A typical case of peat scours (due to copper deficiency) in cattle. Cunningham in the October 1948 "Journal" said: "Practically all reclaimed peat land in New Zealand is deficient in copper . . ."

Copper Deficiency

THOUGH it had been known for many years that dairying on peat country had its difficulties and that periodic spelling of stock off the farm was necessary to maintain them in good condition, nothing which indicated that a deficiency of copper could be present in New Zealand soils was published in the "Journal" until 1944.

THE few paragraphs in which copper was mentioned referred to its use in controlling internal parasites and there were dire warnings of the dangers of copper poisoning, particularly in sheep, which cannot tolerate a high copper intake.

In the last 16 years, however, the position of copper as an essential element has become known and, though there have been some arguments over the relative roles of copper and molybdenum, it can safely be said that copper is essential in animal nutrition. The clue that copper might be deficient in certain areas, particularly in peat soils, was first seen when the role of copper in worm drenching was considered. The December 1944 "Journal" contained an article by Dr I. J. Cunningham, Wallacevile Animal Research Station (now Assistant Director-General of Agriculture) in which he discussed copper in the following terms:

> The practice of drenching with bluestone and nicotine sulphate arose from the known deficiency of these materials in dealing with internal parasites, infestation with which was argued from the scouring symptoms. When, however, the present series of investigations into peat land scouring were undertaken it was realised that the curative properties of bluestone were capable of another interpretation. In short, the effectiveness of bluestone treatment suggested the possibility that an actual dietary deficiency of copper might exist, and that this deficiency might be the cause of the disease.

There was further proof that copper deficiency existed, said the article, "when the Government veterinarian at Hamilton, Mr H. Doeye, diagnosed enzootic ataxia (irregular gait) in lambs bred on peat soils similar to those on which scouring occurs. This disease of lambs had previously been described in Australia and England and was known to result from an insufficient intake of copper".

The symptoms of peat scours—continuous watery yellow-green scours, particularly when there is any flush of feed, poor milk production, etc.—are well known to farmers on this class of country, but less well known are the troubles associated with beef cattle, such as loss of coat colour and shy breeding. In adult sheep little is seen, but lambs may become paralysed soon after birth. It was surprising that the possibility of copper deficiency had not been considered earlier than the 1940s, but research workers have made up for the late start. Cunningham in his first article in 1944 said copper could be supplied by:

- Drenching with bluestone solution.
- Addition of bluestone to the drinking water.
- Licks.
- Topdressing paddocks with bluestone.

In the September 1946 "Journal" there is a further article on topdressing with bluestone. In this early work it was mixed with ½ per cent by weight of slaked lime or other inert substance to promote free running when used as an aerial topdressing. An obvious inference in this article was that larger aircraft than the Whitney Straight used would enable larger quantities of copperised fertiliser to be used. These copperised topdressings are available today and are the accepted method of applying copper to peat lands.

In an article in the October 1948 issue Cunningham said "practically all reclaimed peat land in New Zealand is deficient in copper. . . ." And later adds: "There is a total of some 400,000 acres of copper-deficient peat throughout New Zealand." Much of this known copper-deficient country has been mapped and farmers in these known areas regularly supply supplementary copper to pastures.

By 1954, however, complications had arisen and in the April "Journal" of that year Cunningham says:

> Copper deficiency in New Zealand was first recognised about 1940, causing unthriftiness, low production, and disease in cattle and sheep pastured on reclaimed swamplands. Soon it was learnt that copper deficiency was not always the full story for in some areas molybdenum also came into the picture. An excess of this element, especially when associated with a low supply of copper, was responsible for some of the disease symptoms. On peat lands therefore two disease states were recognised: the first, a straightforward deficiency of copper and, the second, a copper deficiency accompanied by poisoning due to excess molybdenum in the grass.

Peat was not the only soil type to be affected: "Further work has shown that copper deficiency with or without molybdenum poisoning is not confined to peat soils. Sandy soils, marine and alluvial silts, and other soils . . . are also affected. At present about 1½ million acres of farmed land are known to be involved and about an equal area not yet developed is regarded as likely to prove deficient." The problem had grown.

Much work had to be done on molybdenum, finding the type of soils in which a dangerous excess of this mineral occurred and determining how to prevent the toxic action of molybdenum. Cunningham's 1954 article commented on the interaction of molybdenum and copper:

> It is known that copper and molybdenum act against each other inside the animal. An excess of molybdenum in the ration tends to drive out stored copper and to interfere with the use that can be made of the copper present. On the other hand extra copper in the diet will, within limits, neutralise the effect of excess molybdenum. The position is even more complex, for Australian workers have recently shown that sulphate, in its turn, affects molybdenum storage in the body and if sufficient sulphate is present, molybdenum is got rid of quickly.

In Somerset, England, there is a similar disease to our peat scours called "teart" due to excess molybdenum, but our copper deficiency is not quite allied. A high molybdenum excess causes scouring as in teart, but in New Zealand a low copper intake, plus some excess molybdenum, produces a similar condition. Cunningham goes on:

> For copper deficiency with or without excess molybdenum a method of treatment or prevention is to increase the copper supply.
>
> Prevention should be the objective, as it is the only method that gives results against enzootic ataxia. The scouring symptoms of peat soils can be removed by a short course of dusting with copper solutions, but unless a regular supply of copper is given throughout the year, thrift and production will not be improved.

By 1957 it was possible to inject copper as a copper cerate to control the disease. Cunningham in the September issue of the "Journal" in that year lists the dangerous soils and their approximate areas (where known) and states:

> There are clearly large areas in New Zealand which produce pastures high in molybdenum. [Investigations had by this time proceeded very far from those up to 1944.]
>
> . . . the similarity of chemical composition of pastures from [all] the soils listed . . . suggests the strong possibility that disease controllable by supplying copper could occur on any farm situated on any one of the soils. It is, indeed, likely that such diseases already occur but have been overlooked because they might not recur every year and because the unthriftiness, the greying [of the animal's coat], or the scouring have not been recognised as signs of a disease.
>
> The situation now is changed. It is known that when these signs occur in cattle, it is probable that they are caused by too much molybdenum and too little copper in the fodder, and that probability is very high indeed if the cattle are kept on any of the soils named. It is advisable therefore for farmers on these soils to keep this possibility in mind when inspecting their stock. Copper cerates are effective and economical for treatment of single animals or whole herds.

This is not the whole story, as there are a few areas in which copper in large quantities has apparently not prevented a disease which has the appearance of copper deficiency. Work is still going on, but for most of the known areas the recommendations in the 1957 article have proved satisfactory.

Control of Disease by Vaccination

VACCINATION effectively controls some diseases of both animals and man, but no example emphasises the limitation of vaccination as a means of disease eradication better than does blackleg, an acute and generally fatal disease of calves and sheep. Blackleg is one of the group of gas gangrene diseases characterised by the production of gas in the tissues and death from the toxic products liberated by invading bacteria. *Clostridium chauvoei*, the cause of blackleg, is a spore-forming bacillus and the spores survive in the ground for years to perpetuate the disease.

BLACKLEG spores arrived in New Zealand with unsterilised bone fertiliser from India about the end of last century. The disease was first noticed in Taranaki and is first referred to in the "Journal" in February 1916, in which attention is drawn to an amendment to the Blackleg Regulations. Formerly these had applied only to Taranaki, but the disease had spread to Auckland Province, and parts of the following counties were also declared infested areas: Franklin, Raglan, Piako, Thames, Ohinemuri, Waipa, and Waikato Counties.

Later in 1916 C. J. Reakes, then Director of the Livestock Division, fully described the disease (which had become well established) and its control. At this time and for many years blackleg was thought to be limited in New Zealand to calves.

"The disease," said Reakes, "fortunately is present only in limited areas of New Zealand, but the mere fact of its limited distribution renders it necessary to take all possible precautions to prevent its further spread and at the same time to keep it under control in the already affected localities. This can be done effectively at but slight cost and with but little inconvenience to farmers, provided they cooperate with and assist the departmental officers in carrying out the necessary measures."

Discussing the introduction of blackleg into the country Reakes said:

In Taranaki, so long ago as 1889, isolated cases were found in a small area where this fertiliser [imported bone manure] had been used, and for several years no cases outside this area were noted. Then the disease began to spread rapidly, and it became necessary to take proper measures to get it under control. These measures have proved remarkably satisfactory and effective.

Danger from Imported Manures

The vaccination programme certainly prevented wholesale deaths, but the damage was done and the disease was too deeply rooted to be eradicated easily. Unsterilised bone manure had been a prohibited import since 1905 and sterilisation had been subject to rigid inspection. Finally in 1932 importations of animal manures from India were prohibited; it would have saved endless trouble and expense had these manures never been admitted, for with them also came anthrax, though fortunately this occurs to a very limited extent.

Blackleg control at the time of Reakes's article in 1916 was complicated. Areas in Taranaki and Auckland Province were designated "Infected Areas, A or B". There were restrictions on the movement and sale of young cattle in these areas and permits were required. Cattle could be compulsorily vaccinated, and in A areas no young cattle could be moved or sold unless vaccinated. It is strange to read of these precautions and to realise that at the same time thousands of wounded servicemen were dying from gas gangrene (which was one of the worst "killers" of the First World War) when inoculation would have prevented losses for which medical science, lacking the blessing of penicillin, had no answer.

Reakes says of calves with blackleg: "Medicinal treatment, from a curative point of view, is of little or no value, and the one effective measure is prevention".

Use of Vaccine

By 1918 Wallaceville Laboratory, as the Animal Research Station was then known, had increased the output of blackleg vaccine to 226,000 doses, almost double the number issued in the previous year, to cope with the extension of blackleg control to Auckland Province. In 1919 the infected areas were increased in size so that much of Auckland Province and all of Taranaki were involved.

Inoculation against blackleg began to decrease in the 1920s, some 103,000 doses being used in 1921 and 86,000 the following year. In 1924 the annual report of the Livestock Division stated:

> The need for vaccination of calves is still apparent, but it is satisfactory to report that the disease does not show any increase, nor has it extended to other districts. The continuance of the restriction on the movement of calves out of the quarantine areas is necessary in order to safeguard clean districts.

In 1926 it was suggested by the Department that regulations could be relaxed:

> The number of actual deaths reported as due to blackleg is very small compared with the volume of work entailed in general vaccination. No case of blackleg has occurred in Hawera district for over three years.

Malignant oedema, a disease caused by bacteria which are close relatives of the blackleg organism, and which caused confusion for many years between the two diseases, is first mentioned in the 1929-30 annual report of the Wallaceville Veterinary Laboratory. At this stage the modern type of blackleg vaccine was developed and proved effective.

M. B. Buddle, author of a "Journal" article in 1941 which was to alter completely the previous conception of blackleg in New Zealand.

Sheep Also Affected

By 1941 the number of calves vaccinated had dropped to 10,000 in Taranaki and 22,000 in Auckland Province. However, outbreaks still occurred among calves, there being 200 in Auckland Province in the year with 395 deaths. The November 1941 issue carried an article by M. B. Buddle, then Veterinary Research Officer (now Superintendent) at Wallaceville, which was to alter completely the previous conception of blackleg in New Zealand.

Up to this time it had been considered that the blackleg organism did not affect sheep and that deaths in sheep from "blood poisoning" following shearing injuries, dog bites, etc., were due to malignant oedema and not to the true blackleg organism. Buddle mentioned, however, that: "Observations over the last few years have indicated that true blackleg [in sheep] is apparently widespread throughout New Zealand, and it has been observed in districts where the disease has not been reported in cattle".

In describing the disease Buddle refers to possible confusion with malignant oedema and the necessity for correct bacterial diagnosis of the cause of the mortality. Vaccination with blackleg vaccine would have no effect against malignant oedema, but he says:

> When heavy annual losses from the disease occur on a property following castration and docking in lambs or following shearing, experiments have shown that these animals could be protected by vaccination carried out a fortnight before these operations.
>
> Vaccination has been shown to be very effective in preventing losses from a spontaneous form of the disease occurring in hoggets and is thus analagous to the disease in young cattle.

In the April 1944 "Journal" the veterinary notes gave further emphasis to blackleg in sheep by describing the characteristics of the disease and stressing the need for diagnosis by trained personnel. Since blackleg is similar in effect to anthrax, a disease fortunately rare in New Zealand and quite unknown in sheep here, and to tetanus as well as to "blood poisoning", it was necessary to be sure of the diagnosis before inoculation took place.

In 1944 the "Journal" announced that vaccination when warranted was done free by the Department. Because of the volume of vaccination this policy was soon to become inoperable.

Buddle's next article on the disease (the "Journal" April 1948) continued to press for urgent diagnosis of suspected outbreaks in sheep and to reiterate an essential factor in control of the disease:

> It is particularly important in the control of blackleg that the carcasses of animals which die from the disease should be deeply buried or burnt. As the organisms are present in great numbers in the carcass and in discharges, failure to dispose of the carcass properly perpetuates the disease on the property and intensifies its incidence.

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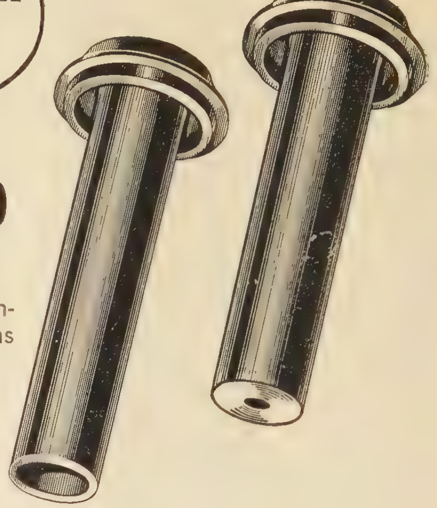

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the disease had become so widespread by 1948 that only regular vaccination on infected properties offered any control of losses.

Vaccination Methods

A full description of vaccination methods was given by C. V. Dayus, Livestock Superintendent, Dunedin, in the May 1949 issue and a very complete discussion of blackleg in sheep by I. M. Cairney, Veterinarian, Dunedin, in the May 1950 issue. The latter drew attention to the "great practical importance" of the slight difference between different types of bacteria causing gas gangrene and commented: "There is an effective vaccination to protect sheep against blackleg, but there is no such vaccine for combating blood poisoning".

The story of the occurrence of blackleg in New Zealand and prevention of it is excellently rounded off by a comprehensive article from M. C. Armstrong, Veterinarian, Timaru, in the December 1953 issue. By this time intra-muscular injection of penicillin had enabled treatment of actual cases to be effective and on affected farms prophylactic treatment with penicillin of unvaccinated ewes was advised if the animals had had to be assisted with lambing.

Vaccination of calves was now being done on a voluntary basis, as the Blackleg Regulations had been revoked in 1952, because blackleg was found to occur outside the known infected areas. One case had even been diagnosed in the South Island, near Christchurch, and Northland farmers at this time were becoming agitated.

Vaccine could now be purchased for vaccinating sheep, but the order revoking the Regulations in 1952 still noted that: "A procedure is being set up under which vaccination will be done by veterinary surgeons employed by farmers' veterinary clubs as well as by Inspectors under the Stock Act 1908".

Restricting the vaccination of calves to those qualified to diagnose the disease gives some protection from the disastrous possibility that an outbreak of anthrax in cattle, though fortunately very rare in New Zealand, could be confused with blackleg.

Vaccines are now prepared commercially and mixed vaccines that protect sheep against blackleg and other forms of blood poisoning at one inoculation are freely available. Control, but not eradication, of blackleg is now a fact, but for over 60 years the disease has been a constant menace on a large number of farms.

MASTITIS — A Menace No Longer

MODERN therapeutics have had an amazing impact on mastitis of dairy cattle. Formerly a disease of the greatest importance to dairy farmers, mastitis has now dwindled to the status of a "nuisance". Such has been the effect of use of penicillin and later-developed broad-spectrum antibiotics on infected udders; and though the disease is still with us and occasionally becomes troublesome and refractory to antibiotics, it is no longer the cause of early culling of valuable cows. Antibiotic treatment has certainly prolonged the average useful life of dairy cattle in this country.

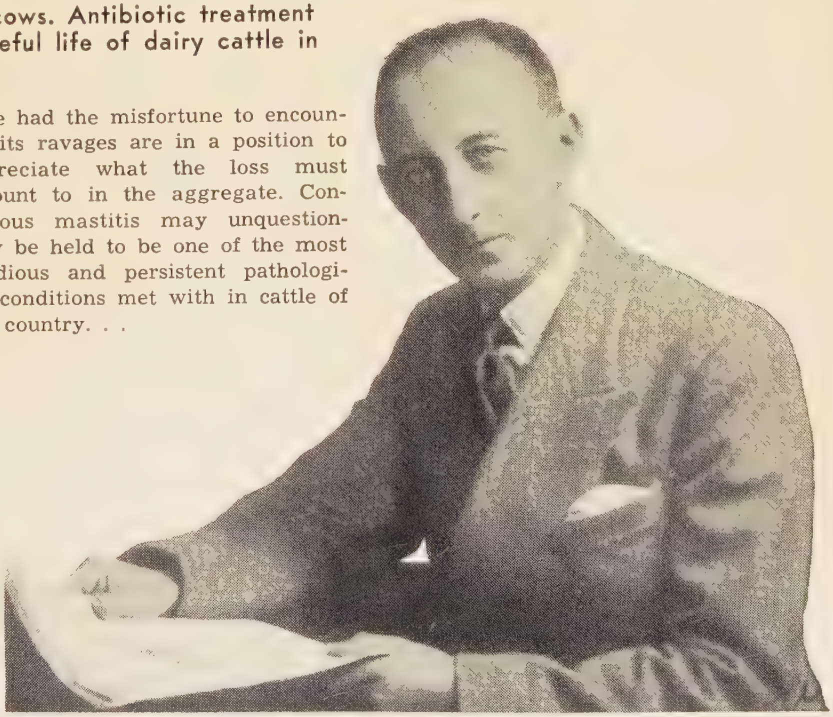
THE changed outlook on mastitis (often in earlier times referred to as mammitis) is well illustrated in the "Journal" over the past 50 years. Between 1910 and 1945 there were 22 references and articles; since 1945 only three issues have carried articles specifically dealing with mastitis, all describing its treatment by antibiotics.

Young farmers have no conception of the difficulties which faced past generations of dairymen who struggled with mastitis control schemes; they know nothing of the hopelessness of attempting treatment with hot fomentation and massage during a severe outbreak.

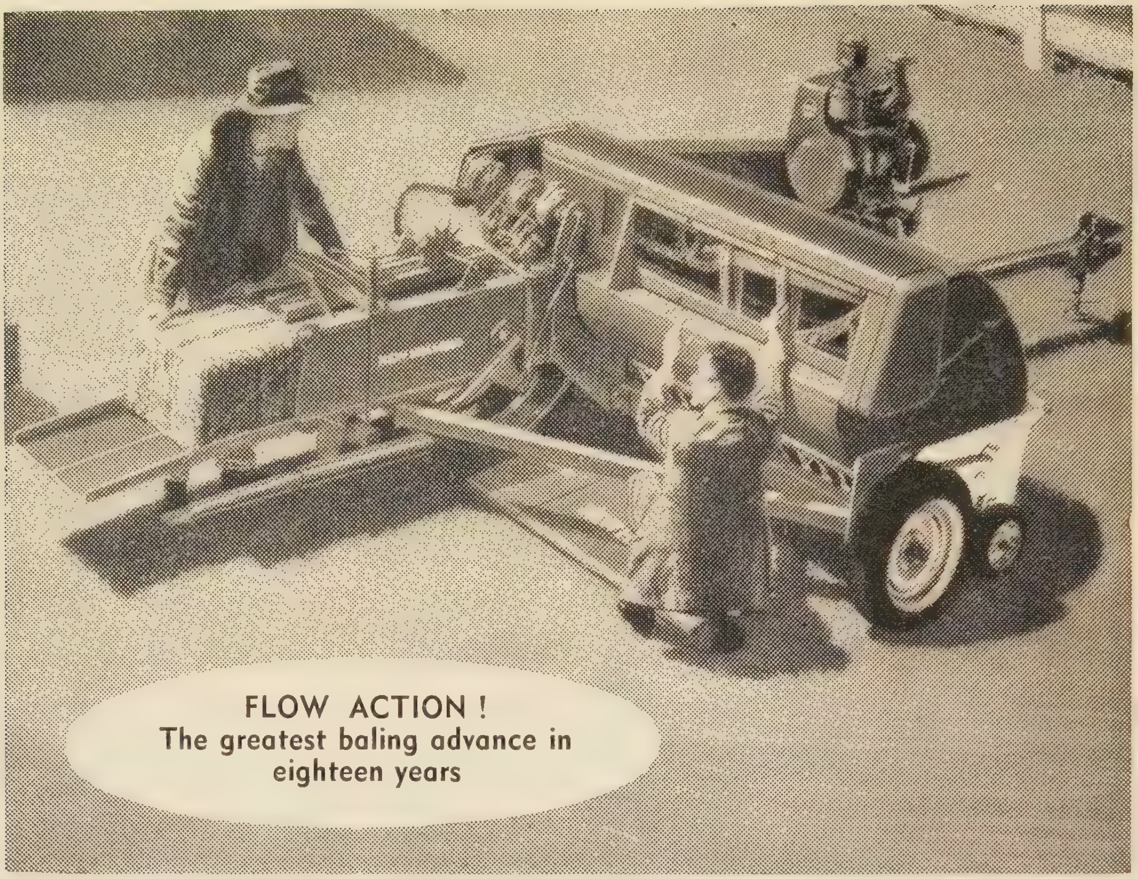
In December 1910 (vol. 1 of the "Journal") H. A. Reid, Officer in Charge, Wallaceville Veterinary Laboratory, wrote:

> It is difficult, with any degree of accuracy, to appraise the monetary loss incurred by the presence of contagious mastitis, but those who have had the misfortune to encounter its ravages are in a position to appreciate what the loss must amount to in the aggregate. Contagious mastitis may unquestionably be held to be one of the most insidious and persistent pathological conditions met with in cattle of this country. . .

Reid describes experiments with vaccines, but concludes: "The treatment though probably beneficial seems likely to mislead and renders efforts to control the disease less effective."



H. A. Reid.



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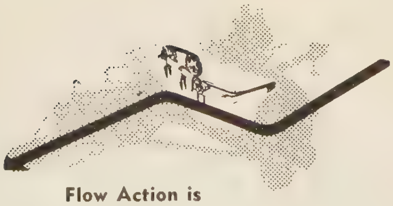

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NH NEW HOLLAND *"First in Grassland Farming"*

Much time and money were to be spent later on vaccines and only the antibiotics eventually ended their production.

Four years later, C. J. Reakes, then Director, Livestock Division (later Director-General), warned farmers that no reliable cure had been developed:

> The only persons who have committed themselves to the definite assertion that they can satisfactorily treat contagious mammitis are the vendors of patented preparations for its treatment, and these, it is presumed, make their business pay, the farmer finding the money therefor. But I cannot blame the farmer altogether for this. He is in a difficulty, and he tries to get out of it. However, the position is clear, and the reliable treatment for contagious mammitis has still to be discovered.

Forty years later an almost "reliable" treatment had been perfected.

Reakes laid down some preventive measures and recommended hygiene: "When a milking machine is used the cups should be well rinsed in clean, fresh water after being removed from each cow . . ."

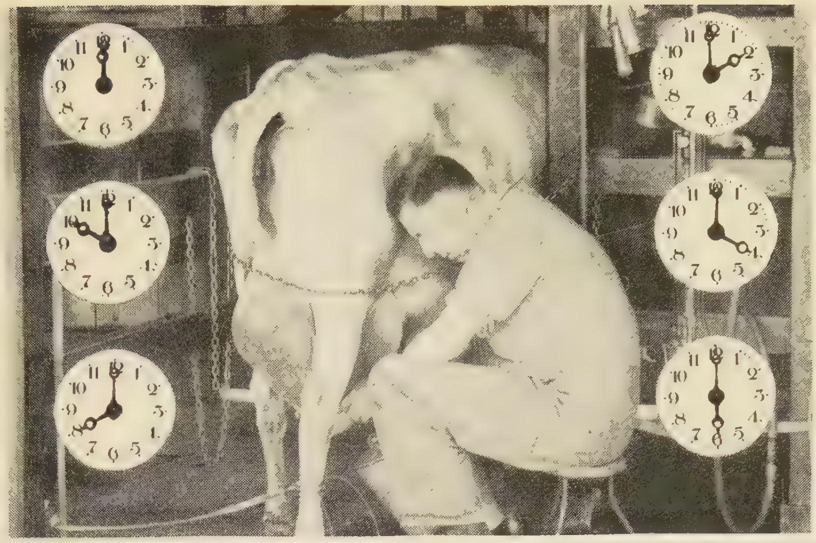
Treatment at that time was mainly one of washing with disinfectant, massage with belladonna ointment, and drenching with Epsom-salt. Hot fomentations also were recommended for acute cases. Such methods required many hours of work, and this at a time when most dairy farmers were still clearing stumps between milkings.

It had been suggested by Reid that farmers should notify cases of contagious mastitis, and we find Reakes in the August 1915 "Journal" advocating the following as desirable measures:

> (1) To schedule the disease in the Stock Act, thus rendering it necessary for an owner to notify it should he know or suspect a case in his herd;
>
> (2) To make it obligatory that any cow proved to be affected with the disease be branded with an official brand before she can be allowed to go off the owner's place.

One can imagine what would have happened, in the light of later incidence of the disease, had these recommendations been adopted. Further in the same article Reakes expressed himself forcibly about the claims made for patent medicines:

> The only drench I know of which can be relied upon to put an end to contagious mammitis. . . would be one containing enough poison to put an end to the cow also.



The need for frequent stripping of affected quarters in acute cases of mastitis was graphically shown in the March 1938 "Journal" and emphasised the laboriousness of the only treatments available for many years.

In the February 1922 "Journal" Reid gave details of various experimental methods of treating mastitis: Drenching with formalin and udder injection with colloidal metals, with chloramines, and with various dyes tested during the First World War on wounds. General treatment was also prescribed:

> Needless to state, in addition to the udder injections the patient must receive local and general treatment. This comprises in addition to the general well being, relief of painful internal symptoms by hot fomentations to the udder, followed by massage with sedative liniment, application of wetpacks and suspensory bandage in certain cases, and saline laxatives internally.

Such treatment of half a dozen cases would be a full day's work.

The general conclusions were that the results of the experiments were disappointing.

The standard Departmental advice at this time was to dry off and fatten affected cows to prevent their becoming centres of infection.

By 1925 there had been systematic trials of preventive vaccines prepared by proprietary companies. C. S. M. Hopkirk, Acting Officer in Charge, Veterinary Laboratory, Wallaceville, in an interim report in the September "Journal" stated:

> . . . sufficient time has elapsed . . . to show that vaccination with the two prophylactics reported upon has not given the expected immunity, and that cows vaccinated have no greater resistant powers to infection than those not vaccinated.

At this time over 2,000 milk samples annually were being received at Wallaceville to determine the presence of mastitis. These were sent mainly by individual farmers.

A brief statement in the October 1931 issue announced that the Livestock Division of the Department of Agriculture had initiated a systematic method of dealing with contagious mammitis in dairy herds and a number of farmers had agreed to carry out the method. This was the beginning of the great attempt to limit the spread of mastitis within herds and to classify cows by regular microscopical examination of milk samples, and so grading them that clean animals were milked first, slightly affected cows next, and definitely affected last.

"The grouping system of milking dairy cows commenced last year . . . has given promising results," said the 1932-33 annual report (quoted in the December 1933 "Journal"). Fifty herds were involved and farmers were advised to begin this method of mastitis control.

By 1936 a subsidiary laboratory had been opened at Hamilton for milk-sample examination, but research went on.

In March 1938, shortly after the "Journal" had been enlarged in size and scope, it presented a well illustrated article which indicated the measures being adopted to alleviate mastitis in infected cows. About this time the brom-thymol-blue test was

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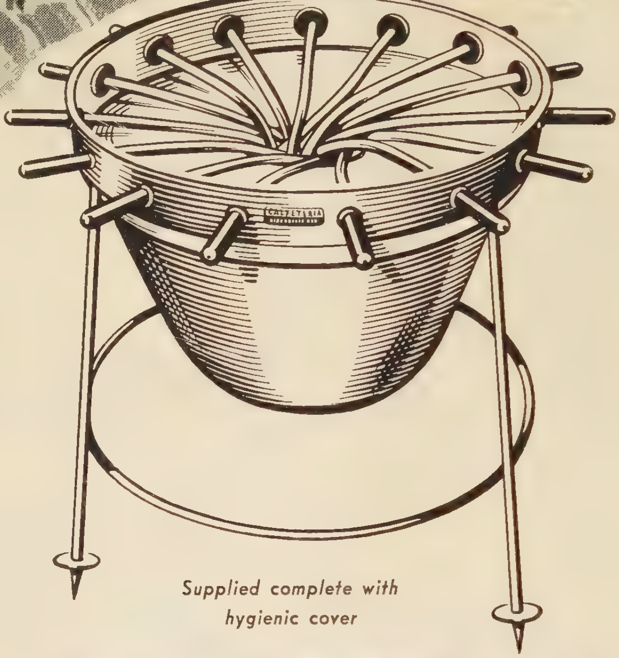

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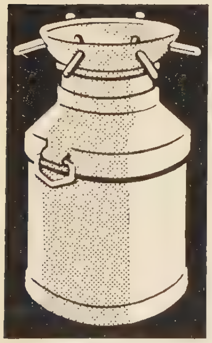

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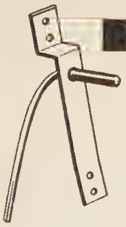

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introduced to enable farmers to separate infected cows from clean animals, but it failed to live up to expectations. Drenching, frequent stripping, and massage were recommended.

The depressing picture of mastitis was shown by a section of the Department's annual report, published in the November 1938 "Journal":

> Mastitis continues to be a cause of much loss of production among dairy herds not only in infected animals, but also from a culling or replacement point of view. . . The prevention and control of the disease through herd and shed management must continue to be given first consideration.

In the March issue of the following year, the Acting Director of the Animal Research Division wrote: "The mastitis-control scheme which has been operating [in the Waikato] during the past eight years has been critically reviewed . . . and it is considered that this scheme will need considerable revision before it can be applied generally."

In the March issue of 1945 Hopkirk, in the last article of the pre-penicillin days, cautiously stated: "Present day knowledge is too incomplete to lay down definite rules for prevention. However, considerable benefit will accrue by observing rules of cleanliness and common sense."

One of the rules he advocated is sensible, but difficult to carry out: "Heifers should enter bails first for milking, then clean cows, and finally known affected animals. It is preferable to keep special bails for heifers." Such a routine is difficult to maintain conscientiously, because a supposedly clean cow may develop mastitis overnight and so upset the programme, and cows are creatures of habit.

Improved drugs, however, had become available and sulphanilamide drenches and also injections of acriflavine into the quarter were mentioned. Farmers of that day will remember sulphanilamide-in-oil and how difficult it was to handle.

The availability of penicillin in the form in which it came into general use was announced by R. W. Roach, then Veterinary Research Officer, Ruakura, in the July 1948 "Journal". The drug had been tested in various ways in the previous season and in 1948 it was possible to put it on the market in a water-soluble cream containing a dose of penicillin sufficient to deal with normal infection.

The Livestock Division had conducted demonstrations to farmers all over New Zealand so that all interested were conversant with the requirements. It seems astonishing, now that there are tins of penicillin and other antibiotic tubes in every cowshed in the country, that the initial demonstrations took place only 12 years ago.

One of the most significant illustrations for the dairy farmer ever published in the "Journal" was the first one showing the use of penicillin for treatment of mastitis, which appeared in the July 1948 issue.

A warning about the risk of the development of penicillin-resistant organisms—precisely what happened later, when the H-bug became a serious problem—was given by J. F. Filmer, Director of the Animal Research Division in the August 1949 "Journal". He wrote:

> . . . if too small a dose of penicillin is given, or if treatment is stopped too soon, the more susceptible germs are killed, but the few more resistant ones survive and in the absence of competition they multiply rapidly.
>
> Therefore all cases should be treated early, a full course of three tubes should be given and the whole contents of one tube should be injected at each treatment.

Penicillin treatment of cows at drying off was also discussed in this article.

The use of larger doses of penicillin or of other antibiotics, such as streptomycin, was discussed in the November 1955 "Journal". This article again warned about the deleterious effects of milk containing penicillin on cheese making: "If 300,000 units of procaine penicillin are injected into infected quarters, the milk from two or three of these quarters at the next milking will inhibit starter in a 900-gallon vat."

Mastitis control has come a long way since the days when foments and massage were all that stood between production and culling. Farmers should appreciate the rapidity with which the benefits of this overseas research reached the milking shed.

What is taken for granted now was unknown only 12 years ago.

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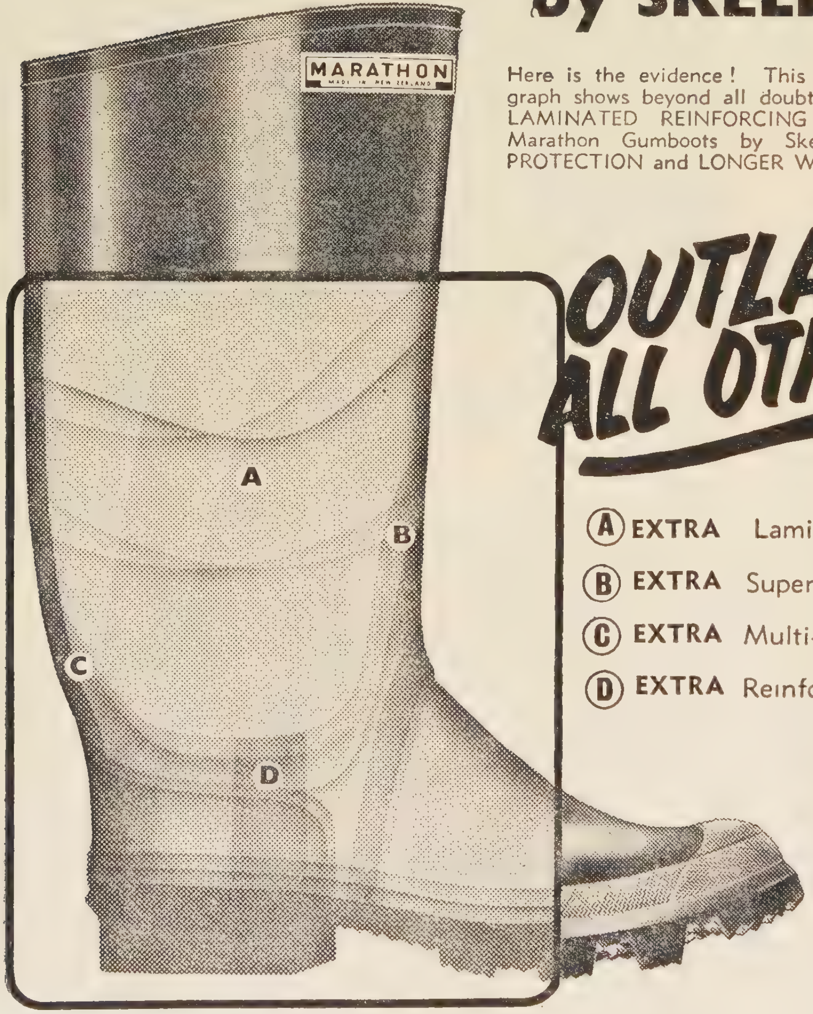

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Tuberculosis of Farm Animals

"Tuberculosis is prevalent to a sufficient extent amongst the cattle of this Dominion to merit the serious consideration of the subject by every stockowner . . ."

So wrote J. A. Gilruth (1910) in the first paper to appear in the "Journal" on tuberculosis of animals, a paper which is remarkable for its clarity and comprehensive range.

GILRUTH pointed out the deadly dangers to public health and to livestock from drinking tuberculous milk, a warning which did not fall on stony ground, for in 1911 the results of a pasteurisation demonstration at Glen Oroua factory were reported by C. J. Reakes. Pasteurisation plants were installed in several factories, especially to safeguard whey and skim milk for animal feeding.

The adoption of pasteurisation at such an early stage sealed off effectively a serious source of spread of the disease.

Reakes, writing again on tuberculosis in 1913, warned that pigs contracted the disease through access to cattle droppings on pastures and that in spite of pasteurisation of whey and skim milk, farmers required to take precautions in management to limit the spread of the disease.

International Commission

The findings of the International Commission on Bovine Tuberculosis given in detail in the May 1911 "Journal" have been the backbone of eradication techniques throughout the world to the present day.

Control is discussed under two different conditions:

1. Where a herd is free from tuberculosis and is to be kept so.

2. Where one or more animals in the herd are infected and the purpose is to eradicate the disease and establish a sound herd.

General precautions given are that animals showing clinical evidence of the disease should be promptly eliminated, all milk from tuberculous cows that is used for food should be pasteurised, and when diseased animals are found the stables from which they are taken should be thoroughly cleansed and disinfected.

British Legislation

The introduction of a Milk Bill and Tuberculosis Order in Britain is reported in the May 1913 issue of the "Journal". Speaking at a large meeting of dairy farmers at Salisbury, England, called to consider the new legislation, a Mr Sadler, addressing the meeting said:

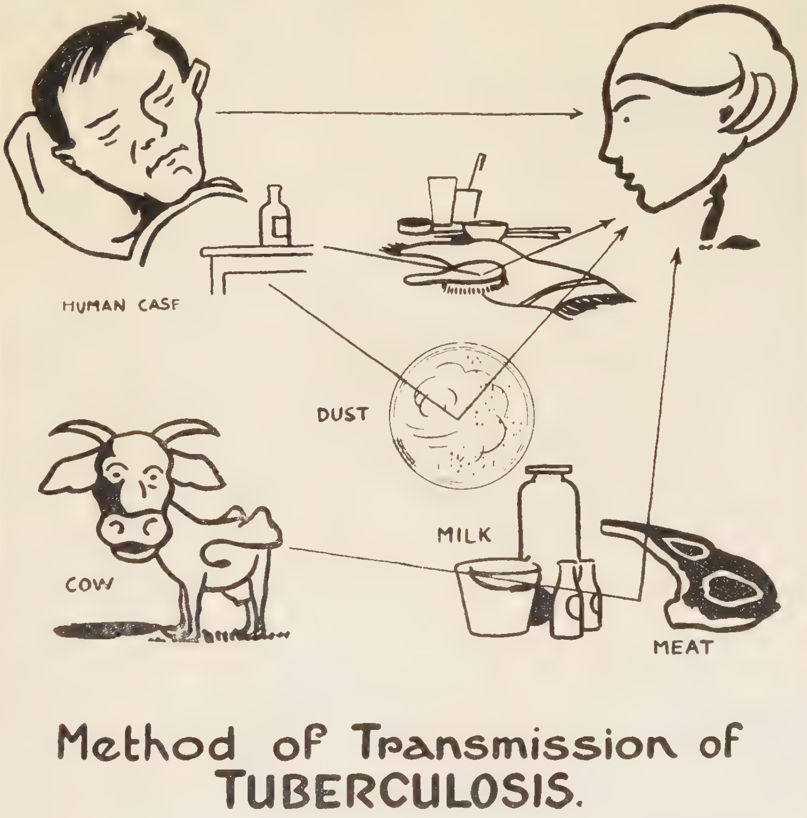
> Why, in the name of Goodness should not the people who send us butter and cheese from foreign countries be put under the same regulations?

In the next decade no references to eradication of tuberculosis are made, but, naturally, during the First World War little could be done.

A brief official note in 1920 informed the New Zealand farmer that the Argentine had introduced a compulsory tuberculin test for cattle imported into that country.

Tuberculosis in Poultry

The first reference to tuberculosis in poultry was made by Gilruth in 1910 and F. C. Brown (1921) gave the symptoms of the disease and described it as the most serious the poultryman had to contend with. In 1924, 1927, and 1929 the same author detailed measures to be taken to eradicate the disease, and no doubt his advocacy of wholesale burning of affected poultry and subsequent methods of manage-



1939—Bovine tuberculosis in its spread to humans was dealt with in contributions by the Department of Health. The above illustration accompanied one of these articles.

ment could well have contributed to the relatively low present incidence of tuberculosis in poultry.

Tuberculin Test

In 1925 the "Journal" recorded extracts from the annual report of the Director of the Livestock Division on the incidence of tuberculosis in animals in which reference is first made to the use of the tuberculin test in New Zealand. The test was largely used free of cost to the farmer on a voluntary basis on cows supplying milk for human consumption. The report shows that of 397,432 cattle examined at the works 5.41 per cent were found to be tuberculous.

In 1927, from a similar report, the expansion of tuberculin testing and the increased awareness of the farming community in reporting "clinical cases" were considered to be beneficial in the prevention of spread of the disease.

About this time new techniques of tuberculin testing and improvements in the production of tuberculin were being developed overseas. C. S. M. Hopkirk (1926) recorded experimental trials of testing techniques recommended by the British Medical Research Council carried out at the Wallaceville Veterinary Laboratory. It is interesting that the caudal fold test (the standard test used today in New Zealand) proved equally as reliable as the cervical double intradermal test.

Comprehensive Review

After ten years, ten years of economic depression, T. A. Blake (1936) in an excellent article reviewed all aspects of tuberculosis in farm animals. He pointed out research work done in Scotland and England where of 365 tuberculous children under five years of age 50 per cent were infected with the bovine type. At the same time he acknowledged the effect of the Stock Act 1908 in controlling to some extent the disease in New Zealand.

Of the farming community Blake stated:

> The enlightenment of the farmer and his knowledge concerning tuberculosis, combined with his very sensible readiness to report and cull suspected animals, have been a most important factor in the suppression of what might have become a far more serious problem had the owners of our herds been apathetic and negligent in this matter.

In the last sentence in his article Blake sounded the tocsin for the next 20 years:

> New Zealand could not put forth such gigantic effort as has been demonstrated in America, and. naturally, it would not be required; but it might be possible in the near future to carry out some plan of elimination in certain areas as a preliminary step to greater things.

E. J. Simmons (1938) warned pig keepers of the dangers of pigs becoming infected with tuberculosis.

Bovine tuberculosis in relation to its spread to humans was succinctly described in contributions by the Department of Health in 1939 and again in 1943.

D. Marshall (1940) in discussing tuberculosis in pigs and poultry drew attention to the many sources of infection which still remained within the Dominion.

The Director of the Livestock Division (1941) recorded that 14,458 cattle were tested voluntarily at the owners' request and rightly pointed out that though the system of clinical inspection supplemented by biological testing of composite milk samples was in existence, only by the tuberculin test could eradication of the disease be accomplished.

A. G. Brash (1943) described the symptoms of tuberculosis in bovines. A. C. Howse (1949) ably reviewed and brought up to date the position of tuberculosis of poultry and I. G. Watt (1951) reiterated the dangers to humans of bovine tubercule infection.

Momentous Steps

In 1945, however, the first momentous step was taken to control bovine tuberculosis in cattle by the passing of an amendment to the Stock Act making tuberculin testing in town milk supply herds compulsory. The voluntary cooperation of producers mentioned in Departmental reports had led to this legal action being taken.

The progress of the scheme was summarised in the "Journal" in 1952 by the Minister of Agriculture. Various factors had prevented the rapid implementation of the scheme, but for the year up to the end of January 1952, 57,952 cattle in town milk supply herds had been tested with a reactor rate of 6.6 per cent. The Minister drew attention to the comparatively large numbers of slightly infected animals and to the priority given to the testing of herds supplying raw milk for human consumption. Reference was made to the further institution of heat treatment stations, so that 85 per cent of all milk sold in urban areas was pasteurised.

Factory Supply Herds

The Minister pointed out the great importance attached to tuberculosis eradication in overseas countries and concluded with a reference to consideration being given to the introduction of a scheme of eradication in factory supply herds.

"The step to greater things" visualised by Blake (1936) had been taken.

The most comprehensive article in the "Journal" on tuberculosis of farm animals up to 1952, the year in which it appeared, was by P. J. McCann. McCann gave an up-to-date description of tuberculosis in cattle, pigs, sheep and goats, horses, dogs, cats, and poultry. The methods of infection and spread of the disease were recorded and the tuberculin test and its use described. Successful methods of control and eradication in other countries were dealt with and the author concluded that:

> . . . eradication of the disease from cattle in New Zealand is an objective worthy of the greatest and most persistent efforts.

Reviews of tuberculosis in poultry were written by Howse (1955) and M. E. White (1955), and the mechanisms whereby the disease was spread within a farm were outlined by V. E. Senior (1956). The relation of hygiene and farm management in the control of tuberculosis was discussed by A. Fisher (1959).

In 1958 the Minister of Agriculture, Mr C. F. Skinner, announced details of a voluntary scheme for tuberculin testing of factory supply herds. The Minister stated that the devising of a workable scheme had not been easy, but that the proposals would avoid undue hardship where a high incidence of disease occurred. He expressed the hope that all herds in New Zealand would eventually be virtually free of tuberculosis.

A New Vista

The scheme is embodied in the 1958 Amendment to the Stock Act, and opens a new vista in the control of the disease.

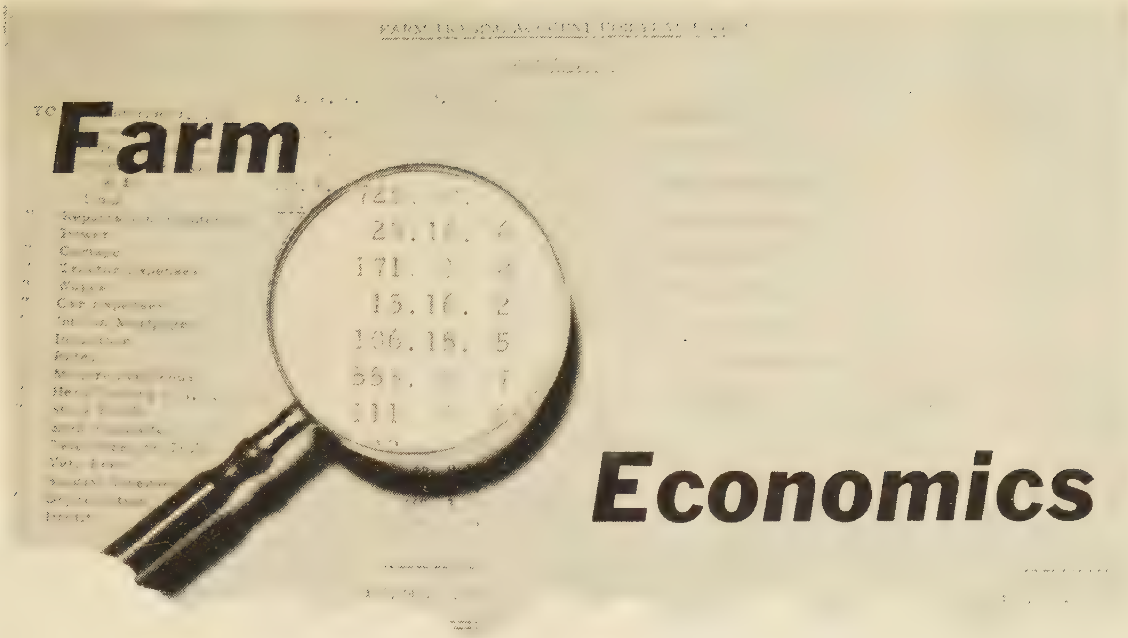
The veterinary manpower of the Dominion is making a concerted effort to eradicate one of the most insidious diseases known to medical science.

Fifty years may seem a long time. It is indeed half the time since the skills and science of Western civilisation were brought to this country.

The exhortation of Gilruth (1910) has not gone unheeded; ways and means have been found to surmount the peculiar difficulties of the problem of tuberculosis in animals.

◆

Farm Economics



THOUGH in 1919 A. D. Park, the Accountant to the Department, wrote several articles dealing with farm bookkeeping and farm costing, and in 1923 E. J. Fawcett's studies of the economics of operations of the six-horse team in Canterbury crop production appeared, it was not until 1925 that reference was first made in the "Journal" to the need for agricultural economic studies.

IN that year, writing about hill country deterioration in the mid-western districts of the North Island and the methods needed to arrest it, A. H. Cockayne said:

> I would also suggest that a very complete study of the economics of hill-country grassland farming should be carried on simultaneously with any experimental work undertaken, and that for this purpose a small branch of the Fields Division be formed devoted to the study of agricultural economic problems, among which, to begin with, the question of the economics of second-growth country should be carefully studied.

Economics Research Section Formed

The next year a small farm economics section was formed under Fawcett, who in the "Journal" for August 192 indicated that it was desirable for a certain number of picked farms in each district to be put under a very accurate system of costing and that a large number be subjected to a survey so that they might be checked against the standard. The main object of these methods was to obtain economic data on the farming industry of the Dominion.

The survey method prevailed in New Zealand, and in August 1927 the results of the first farm economic survey, for a group of dairy farms in Piako County, appeared. Gross returns per acre and the cost of producing a pound of butterfat were computed for each farm, in addition to which the net profit was computed on a standard basis.

Fawcett continued for a time with these surveys and in October of the same year he published some results for dairy farms in Raglan County and in January 1930 the results for the first survey of sheep farms. These latter were hill country units on the east coast of the North Island and the main economic index computed for them was "profit per 1,000 sheep".

From the early 1930s until after the Second World War little was published on farm economics or farm management. A notable contribution by W. P. Riddet and C. P. McMeekan in February 1934 presented the results of a survey on pig production on 60 dairy farms in the Manawatu district. The results showed that the most efficient farm had a return of 48 lb of pig flesh per 100 lb of butterfat produced, and the authors considered this index was the best available for comparing relative efficiency in pig management.

Farm Management Surveys

P. W. Smallfield's considerable influence on agricultural economic thought and on farm management literature became evident in 1944, when under his guidance there appeared in March of that year the first of a series of articles setting out the management practices on farms in the major farming areas of the Dominion. The articles continued for three years and many contained financial and economic data as well as information on the physical production being achieved on the farms.

He was also responsible for the series of historical articles which set out the development of the farming systems of the Dominion, and on his appointment as Director of the Rural Development Division in 1945 this type of article became a feature for a period in the "Journal". Under his direction, in March 1947, B. E. King gave an outline of the pastoral age in New Zealand and in the following month R. H. Scott published a history of cereal production.

In the same year Smallfield himself traced the development of meat, wool, and dairy production in New Zealand, and began a series, "Intensive Grassland Farming", which was continued in 1948.

In these two years a considerable amount appeared in the "Journal" on agricultural economic history and general farm management. A series of articles traced the development of farming in land districts as well as the general farm management practices adopted in the main farming regions of these districts. J. W. Woodcock started the series by writing on farming in Otago and R. P. Connell later wrote two articles on farming in Canterbury. E. B. Glanville, in May, June, and July 1948, gave the story of farming in North Auckland.

With the building up of a small staff of field officers in farm economics after 1944 training was necessary so that they could obtain some background information on farming and farm management in the districts in which they worked. This initial training resulted in a series of articles covering farming development in countries. P. Van Praagh began the series in April 1950 by describing the farming and farm management practices in Rangiora and Eyre Counties in North Canterbury, R. C. Schofield in June 1952 dealt with Levels County, and A. H. Mouat and J. G. Richards in February and March 1954 wrote about Clutha County. The articles dealt with the development of farming, the physical factors which influenced the farming pattern, and the management practices in the counties.

By the early 1950s these descriptive articles had served their purpose and there was a strong feeling among field economists that their work should have as its objective the improvement of farming efficiency, and any material they collected should help to pinpoint farming weaknesses either in regions or on farms. There was now a swing back to the farm surveys by which farm management and economic data were collected from farms in certain areas. The results of the first of these, “Farm Management Survey in the Southern Maniatoto Plain”, appeared in July and August 1955. It showed that those farmers with adequate areas of lucerne achieved the highest net return per acre. A survey of farming in Akaroa County appeared in November 1955 and one on the Ida Valley in Central Otago in December 1957. It was now apparent that this type of survey was a useful extension aid, as it gave factual information on farming weaknesses and the extent of the weaknesses in an area.

However, there was now emerging another phase on farm economic work—the use of adequate farm management and financial records in the farm management process. In “Economic Factors in Hill Country Development” in January 1957 R. H. Scott showed how the records for an individual farm could be analysed and used, and also showed how the economic efficiency index “owner surplus per acre” was computed. He followed this in February 1958 with an article comparing the physical and financial results for several groups of dairy farms in New Zealand and in this stated:

> No serious attempt has so far been made to analyse the differences in results achieved on the farms. Some are due to climatic, soil, and topographic variations, whereas some are due to management differences; that is, the efficiency in using and combining the resources available. As information becomes available over a longer period an analysis of the economic and management data may give a lead on how to combine and use the resources more efficiently to achieve greater net returns.

He followed this in October 1958 by describing farm production forms which could be used to trace the physical production from farms over a period, and in July 1959 showed how the analysis of accounts could help in diagnosing weaknesses in a farm enterprise.

Farm economic work as illustrated from writings in the “Journal” has now passed from the general to the particular and is assuming its real role as an aid to the farmer in assisting him to make sounder decisions on the combination and use of his resources.

Radio Broadcasts for Farmers

RADIO broadcasts for farmers will be given during August as follows:

1XH Hamilton, 12.33 p.m.

8 August—“Spring Management on the Dairy Farm”, by P. F. Goulding, Farm Advisory Officer, Department of Agriculture, Hamilton.

15 August—“Planning the Summer Vegetable Garden”, by E. Toleman, Horticultural Instructor, Department of Agriculture, Hamilton.

22 August—“Spring Topdressing”, by S. D. Clay, Farm Advisory Officer, Department of Agriculture, Hamilton.

29 August—“Surface Drainage”, by D. F. Scott, Machinery Instructor, Department of Agriculture, Hamilton.

1YZ Rotorua, 7.15 p.m.

10 August—“Pollen Deficiency in Hives”, by D. A. Briscoe, Apiary Instructor, Department of Agriculture, Tauranga.

24 August—“Young Farmers’ Clubs”, by the Rotorua Y.F.C. district committee.

2XG Gisborne, 8 p.m.

9 August—“For the Orchardist”, by J. D. Overbye, Horticultural Instructor, Department of Agriculture, Gisborne.

30 August—“Planning Erosion Control Work”, by A. Black, field officer, Poverty Bay Catchment Board.

2XA Wanganui, 8 p.m.

4 August—“For the Country Woman”, by Mary Macdonald.

11 August—“Farming News”.

18 August—“Sheep and Wool Notes”, by P. C. Marshall, Sheep and Wool Instructor, Department of Agriculture, Wanganui.

25 August—“Seed Certification”, by A. K. Booth, Farm Advisory Officer, Department of Agriculture, Wanganui.

2XP New Plymouth, 8 p.m.

4 August—“News and Views from the Department of Agriculture’s Farm Advisory Division”, by S. H. Henry, Farm Advisory Officer, Department of Agriculture, Stratford. Y.F.C. Session, by David Smith, North Taranaki Y.F.C. district committee.

11 August—“Blackleg in Sheep”, by A. E. Murdoch, Livestock Instructor, Department of Agriculture, Stratford.

25 August—“Radio Vet.”, by J. H. Macdonald, Veterinarian, Department of Agriculture, New Plymouth.

3YA Christchurch, 12.20 p.m.

15 August—Review of “The New Zealand Journal of Agriculture”, by E. G. Smith, Instructor in Agriculture, Department of Agriculture, Rangiora.

4YA Dunedin and 4YZ Invercargill, 12.36 p.m.

1 August—“Lambs at the Works”, by A. Baker, Supervising Meat Inspector, Department of Agriculture, Invercargill.

8 August—“Grain Growing”, by A. R. Rankin, Fields Instructor, Department of Agriculture, Invercargill.

15 August—“Feeding the Ewe Flock”, by A. W. J. Apps, Livestock Instructor, Department of Agriculture, Palmerston.

22 August—“Lucerne as a Pasture”, by W. A. Lunn, Fields Instructor, Department of Agriculture, Ranfurly.

29 August—“Supplementary Feed Crops”, by G. M. Bennett, Farm Advisory Officer, Department of Agriculture, Invercargill.

Regular Sessions

1YA Auckland, Mondays at 12.36 p.m. (“Country Journal”, including “Report from Ruakura”), Tuesdays, Wednesdays, Thursdays, and Fridays at 7.45 p.m. (“Country Journal”), Thursdays at 12.33 p.m. (“News for the Farmer”).

1XN Whangarei, Mondays at 8 p.m. (“Northland Stock Market Report”, followed by “Farming for Profit”), Wednesdays at 8 p.m. (“Farming for Profit”), and Fridays at 12.33 p.m. (“Farm News”).

1XH Hamilton, Mondays at 12.36 p.m. (“For the Farmer”, excluding first Monday in month and public holidays), Wednesdays at 12.33 p.m. (“Report from Ruakura”).

1YZ Rotorua, Wednesdays at 7 p.m. (“Bay of Plenty Journal”), Thursdays, 12.33 p.m. (“News for the Farmer”).

2YZ Napier, Tuesdays at 7.10 p.m. (“The Hawke’s Bay Farmer”) and Thursdays at 12.33 p.m. (“News for the Farmer”).

2XG Gisborne, Tuesdays at 8 p.m. (“Farm Session”).

2XP New Plymouth, Thursdays at 8 p.m. (“Farm Session”).

2XA Wanganui, Mondays at 8 p.m. (“For the Man on the Land”), Tuesdays at 8 p.m. (“Farm Supplement”), and Thursdays at 8 p.m. (“Farm Topics”).

2XB Masterton, Fridays at 6.45 p.m. (“Farm Session”).

2XN Nelson, Thursdays at 8 p.m. (“Nelson Farm Topics”).

2ZA Palmerston North, Mondays at 12.36 p.m. (“Country Digest”) and Fridays at 8.30 p.m. (“Country Digest”, including Feilding stock market report).

2YA Wellington, Mondays, Tuesdays, and Fridays at 7.10 p.m. (“Farm Session”), Thursdays at 12.33 p.m. (“News for the Farmer”).

3YA Christchurch, Mondays at 12.20 p.m. (“Country Session”), Thursdays at 12.33 p.m. (“News for the Farmer”), and 7.10 p.m. (“Home Paddock”).

3XC Timaru. Wednesdays at 8 p.m. (“Farmers’ Weekly News Service”) and Saturdays at 10.30 a.m. (“Country Mailbag”).

3XC Timaru, Wednesdays at 8 p.m. Thursdays at 12.33 p.m. (“News for the Farmer”).

4YA Dunedin, Mondays at 12.36 p.m., Wednesdays and Thursdays at 12.33 p.m.

4YZ Invercargill, Mondays at 12.36 p.m., Wednesdays and Thursdays at 12.33 p.m. (“News for the Farmer”).

Hydatid Testing Station Opened

THE third stage of the campaign to eradicate hydatids from New Zealand began on 24 March when the National Hydatid Testing Station at Taieri was opened. The first and second stages were the formation of voluntary eradication committees and the establishment of the National Hydatids Council, with regular dosing programmes.

MORE than 100 people were present at the opening, which was performed by the chairman of the National Hydatids Council and Assistant Director-General of Agriculture, Dr I. J. Cunningham. Among the guests were representatives of a wide range of organisations interested in the eradication of hydatids.

The station occupies about 1,000 sq. ft. in a hangar of the former R.N.Z.A.F. station at Taieri and will eventually have a staff of 14 or 15.

The station was unique, Dr Cunningham said. Nowhere else was there a unit devoted solely to providing a testing service to support a national campaign for the eradication of hydatids.

Dr Cunningham mentioned the value of having the testing station in the same building as the Hydatid Research Unit and under the general supervision of the director of the unit, Mr M. A. Gemmell. The testing station would be able to keep abreast of new testing methods as well as get help with urgent problems.

Mr Gemmell had developed the diagnostic method that would be used at the station. The old method of preparing samples of dog faeces for examination for the presence of hydatid tapeworm involved individual handling and was very slow. The method worked out by Mr Gemmell enables a number of faecal specimens to be prepared simultaneously and so effects considerable savings in time and labour.

Cost

"Without the modern technique which has been developed the cost would be enormous, but even now the cost of testing will be something like

Top—Messrs J. J. Parsons (left), G. W. Key, and T. McCristell, of the National Hydatids Council, study tapeworms under microscopes. Middle—Dr I. J. Cunningham (right), chairman of the council, opens the station. With him is Professor E. F. D'Ath, of the Hydatid Research Committee. Bottom—A staff member demonstrates the station's sample preparation machine.

[*"Otago Daily Times"*

£15,000 a year," Dr Cunningham said. Extra initial costs would bring the Council's expenditure this year to about £16,500. This was about half the council's total funds for the year and was the measure of the council's recognition of the importance of testing.

The site at Taieri had much to commend it, but in serving the whole country it had obvious geographical disadvantages; thousands of samples had to be sent there from all parts of New Zealand. There might be a future need for a station to serve the North Island, and it was something the council would have to consider.

Dr Cunningham pointed out that farmers' committees had been pledged to destroy the hydatid parasite by eliminating the worm from the dog and by preventing reinfection of dogs. Encouragement from the Government, local bodies, and research officers, and from the medical and veterinary professions had helped the formation of voluntary committees, which now numbered more than 800. An important part of their work had been the organisation of over 300,000 dog dosings.

New Dosing Requirements

The National Hydatids Council had met the previous day, and during the opening of the station Dr Cunningham announced important changes in the dosing requirements in the national hydatid eradication campaign.

The council, while recognising that all dogs must be tested, was keeping constantly under study the intervals at which tests had to be carried out. An interval of three months between tests had been adopted as the standard for the initial phase of the campaign.

Now the council considered that educational work on the life history of the tapeworm, on dog hygiene, and on offal disposal was at least as important as dosing and testing.

Dogs would be required to be tested for hydatid infection three times a year instead of four. In this way at least one-quarter of the year would be left free for the hydatid control officer to concentrate on the educational side of his work. Local authorities who adopted this lighter schedule were recommended to leave free of dosing the period or periods of the year when the weather was unsuitable through extremes of either heat or cold.

The council had also decided that dosing could be reduced for defined areas when infection was sufficiently low. Such an area must have at least 300 dogs, and not more than 1 per cent of the dog population should be infected with the hydatid tapeworm or the hydatigena tapeworm. The local authority could apply to the National Hydatids Council to have an area declared a "low incidence" one.

The relaxation of dosing that would be permitted would be:

If low incidence was found at a dosing period in an area, the dogs free of infection could miss the next dosing period, and if at the next dosing period incidence was again low, the clean dogs of that area could be put on once-a-year dosing. The few infected dogs at the first low incidence period would not be excused from the second, normal dosing period.

If a low incidence area slipped back and more than 1 per cent infection was found in the dogs, standard dosing would have to be resumed until low incidence was again attained.

"This programme provides a rational use of dosing and testing, and it is hoped it will prove an incentive to individuals and groups to get, and to keep, districts clean," Dr Cunningham said.

Sample Preparation Machine

The acting chairman of the Hydatid Research Committee and head of the Department of Pathology, University of Otago, Professor E. F. D'Ath, congratulated the National Hydatids Council on the "vigorous, dedicated manner" in which it was tackling the formidable task facing it.

Professor D'Ath referred at length to the sample preparation machine at the station, which, he said, had made the current eradication campaign not only a practical possibility, but an economic proposition. With the manual method first used the laboratory cost of the present programme would have been about £135,000 a year, instead of the £15,000 budgeted for this year's operating costs.

The present machine had originally made it possible to prepare and examine 800 samples a day. With further refinements and a team of six it was now possible to process 2,000 samples a day.

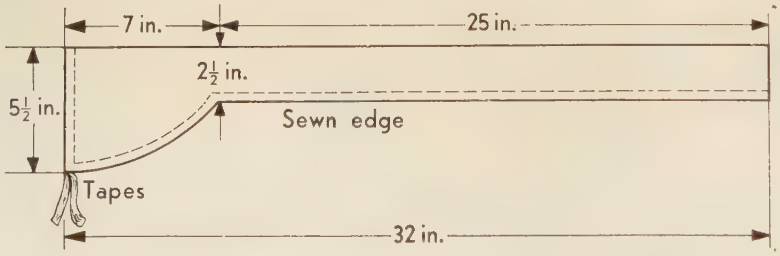
Work was proceeding on the final design and fabrication of a more advanced, automatic machine which, with a team of 10, should make it possible for 4,000 to 5,000 samples to be examined a day. This represented more than 1,000,000 samples a year.

Some 112,940 samples had been examined since the testing station began work in July last year.

◆

Lambing Device

THE simple device illustrated is used for lambing cases of abnormal presentation where the head is presented without the legs. The device encases the head, the tapes being tied firmly so that when pressure is applied the taped end of the funnel grips the lamb behind the head and jaw. Having control over the head enables the operator to repel the lamb into the uterus while its legs are positioned as in a normal presentation. Lambing is simplified by pulling firmly on the narrow end of the device and using the free hand to assist presentation.



The device is made of nylon material. A pattern is cut having a total length of 32 in. with a width of 11 in. tapering to 5 in. for the first 7 in. and 5 in. for the remainder. The wide end is folded into a hem and sewn so that a tape can be inserted and moved freely in the fold. The material is folded lengthwise, forming a funnel, sewn together, and turned inside out to prevent the frayed edges causing damage to the ewe.

Before use the device should be sterilised and disinfected.

The farmer using this device claims that in the last four years he has reduced his losses to negligible proportions. The advantage claimed is that when the device is attached to the head of the lamb the head is not lost when the lamb is repelled into the uterus. The device is flexible, causes no damage to the head or jaws, and is easily carried.

—R. G. CHAMBERS, *Livestock Instructor, Department of Agriculture, Papakura*

Use of Supplementary Feed with Skim Milk in Pig Feeding

THE use of supplementary feed with skim milk in pig feeding is discussed in this article by I. H. Owtram, Extension Officer in Pig Husbandry, Department of Agriculture, Wellington. In the May issue the value of skim milk as a pig food was dealt with by the same author.

SUPPLEMENTARY feeds used with skim milk are divided into two classes, concentrates and bulk foods. Concentrates are meal and grain and include meat meal and dried buttermilk; bulk feeds are root and fodder crops that can be grown and fed to pigs.

Concentrates

Concentrates are used to counteract the lack of completeness and the bulk of skim milk, and their use is absolutely necessary if the greatest possible return is to be obtained from the skim milk.

A newly born pig is endowed with a most remarkable power of growth. At birth it will be perhaps 2½ lb and at 12 months old will be 250 lb or

HEADING PHOTOGRAPH: Pigs being fed on preserved curd.

Fodder-beet being fed to pigs. Home-grown crops are used to boost the falling supply of skim milk in autumn and to feed in winter when the dairy herd is dry.

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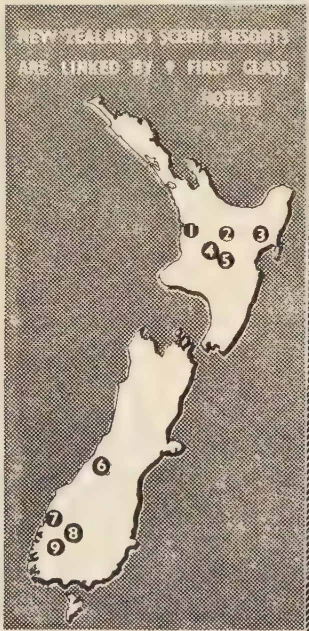
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TOURIST HOTEL CORPORATION OF NEW ZEALAND more, an increase of 100 times its birth weight in one year. A great deal of research work has been done on the growth rate and way in which pigs grow. During the first four to five months pigs build muscle or lean meat rather than fat if the food supply is adequate, but after that age the proportion of lean meat to fat in the pig's carcass will not increase, but if the pig is fed all it can eat it will build more fat than lean meat.

A diet rich in protein is required to build muscle or lean meat. Though skim milk is rich in protein, it is also bulky and liquid, two factors that make it impossible for the young pig to consume sufficient to provide adequately for the growth rate of which the pig is capable.

Therefore to get good results from the skim milk it is necessary to supplement it with a concentrate feed, that is, feed of high value and small bulk rich in protein. A meal mixture containing 1 part of meat meal, 1 part of buttermilk powder, and 8 parts of barley meal would be suitable. The use of this should begin in the creep when pigs are two to three weeks old; at this stage ad lib. feeding by a self feeder is practised.

From weaning at eight weeks old the meal supplement should be 1 lb per pig each day and should be continued until the pigs weigh 100 lb live weight and are about four months old. It should then cease and skim milk only be fed. The change must, of course, be made gradually over a week to 10 days, as sudden changes in diet cause digestive upsets. Tables of recommended rations are given on page 92.

Bulk Feeds

The second class of supplementary feed, bulk feeds, consisting of root and other crops that can be grown on the farm, is used for boosting the falling supply of skim milk in autumn and for feeding to pigs in winter when the dairy herd is dry.

The object is to provide a cheap supplementary feed, as home-grown crops are cheaper than purchased meal. Also, it is possible in districts where grain such as barley and maize can be grown satisfactorily to lower considerably the cost of concentrate feeds by producing the grain portion of them on the farm.

Production of High-quality Carcasses on Skim Milk

While the aim is the production of the maximum pig meat at the minimum cost, it is essential if the best price is to be obtained, that the carcass quality should be as high as possible. To achieve this on skim milk as the basic food requires careful attention to feeding. The production of quality pig carcasses is fully dealt with in Bulletin No. 366.

Meal, a concentrate food of small bulk and high value, should be used as a supplementary feed during the first four months of the pig's life. Picture shows use of a hand cart to facilitate feeding of large quantities of meal supplements.

During the first four to five months of life pigs build muscle or lean meat rather than fat, and after that stage, if fed to appetite, will put on more and more fat and the proportion of lean to fat cannot be increased. Consumers of both pork and bacon today do not want and will not buy fat if they can help it. Joints of pork, rashers of bacon, and ham are required with the minimum of fat. It is essential that the producer should take every care to feed pigs so that they are not overfat.

On dairy farms where skim milk is the basic food for pigs the quantity fed daily must be restricted to below the pigs' appetite once they have reached five months of age and a live weight of 140 lb. At this stage not more than 5 gallons of skim milk should be fed to each pig daily, preferably in two feeds. This quantity should be increased gradually until at six months old and a live weight of 180 lb 6 gallons is being fed daily. This maximum should not be exceeded.

Pigs at this stage do not require any feed other than skim milk and, as most pigs are taken to bacon weight during November, December, and January, there is plenty of skim milk available. When there is more skim milk than the pigs require the danger of overfeeding and so overfattening is greatest. This is not surprising, as farmers naturally do not like throwing away skim milk.

Preserving Surplus Skim Milk as Curd

A surplus of skim milk when dairy production is at its peak can to advantage be preserved as curd by a simple and effective process.

On average dairy farms 40-gallon drums are excellent containers for curd preservation. They are easy to obtain and if a drum of curd goes bad, the loss is restricted to one drum. The process is as follows:

A 40-gallon drum is used, one end being cut out. The drum must be cleaned out thoroughly first and after washing should be rinsed with 1 per cent formalin solution (2 teaspoons of formalin to a gallon of water); after rinsing drums should be stood upside down to drain and dry.

Surplus skim milk is put into the drum. It does not matter whether the drum is filled to the top or not. The skim milk is left until the top of the curd has set to a rubbery consistency. This stage has been reached when, the fingers being inserted between the curd and the side of the drum and the curd pulled slightly away from the side, the curd springs back again to the side on withdrawing the fingers.

The curd takes a day or two to reach the stage described: the warmer the weather is the quicker the curd will form.

After the curd has formed the contents of the drum are thoroughly stirred to break up the curd and allow the gas trapped in it (which has

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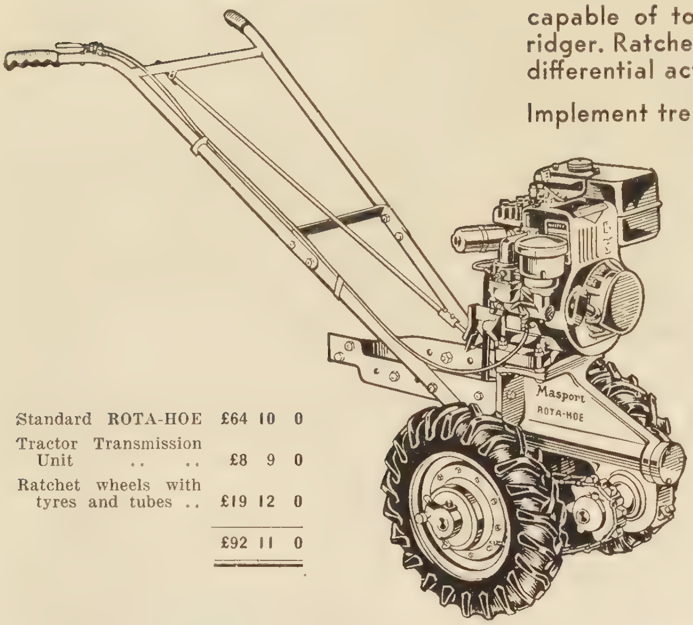

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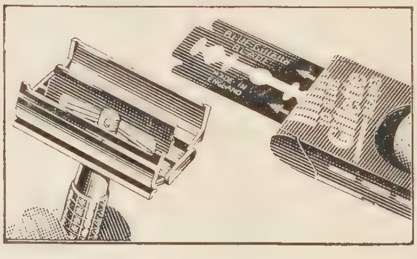

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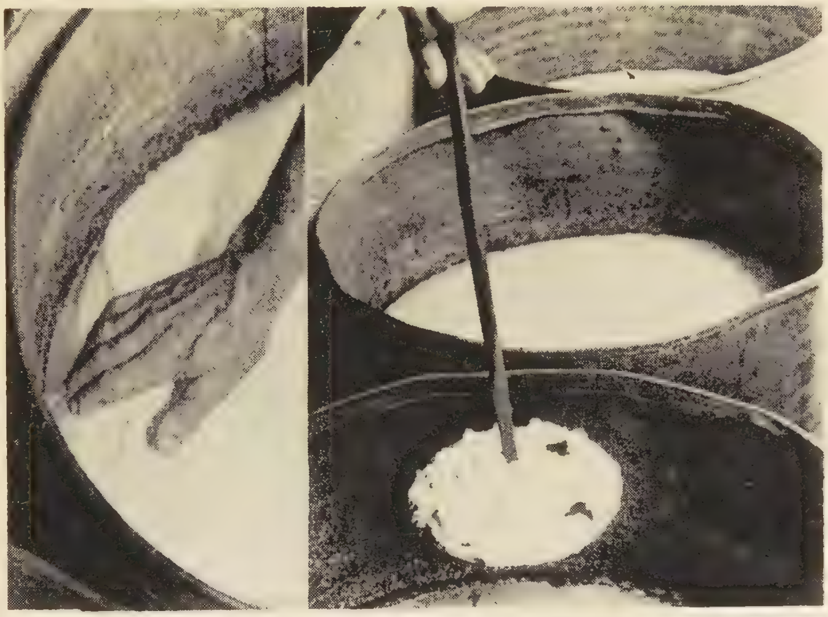
caused it to rise to the top) to escape, and the curd sinks to the bottom of the drum.

When all the curd is at the bottom the whey on top is siphoned or bucketed away, and the drum is filled again with fresh skim milk. The curd formed on this milk will usually sink to the bottom of its own accord, but may require stirring again. The whey is again removed and the process repeated until the curd is to within about 4 in. of the top of the drum. A layer of whey is left over this to seal out the air and the drum is left until required for feeding. Curd preserved in this way will keep for 12 months as long as the whey on the surface is maintained. If the drum is left out in the open uncovered, rain water will usually maintain the seal, but in a very dry autumn it may be necessary occasionally to add a little water.

Surplus skim milk can be preserved as curd by a simple and effective process. →

The process of preserving curd in this way is very similar to the making of silage. In both cases acidity is developed and air excluded. Much larger containers than 40-gallon drums may be used. Tanks that hold 10,000 gallons and more have been used with complete success. On the average dairy farm, however, there is not usually enough surplus skim milk to make the use of larger containers practicable. They are more useful on farms using buttermilk from a dairy factory; this can be preserved as curd in the same way as skim milk.

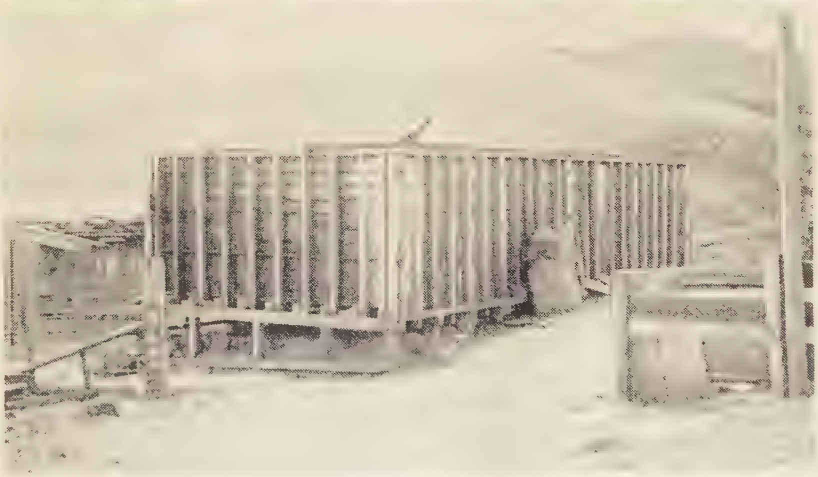


Curd at the correct stage for → stirring to cause it to sink to the bottom.

The whey which is drawn off in preserving the curd can be fed to the pigs, as it contains milk sugar and protein. The best way of feeding this is to mix it with the skim milk that is being fed.

Use of Grazing and Green Feed

In the successful feeding of pigs on skim milk access to good pasture, or failing this the use of green feed, is very important. Sows and litters should be allowed out on good pasture as soon as possible after farrowing. This is by far the most efficient method of avoiding anaemic scours in the litter. If the weather is suitable, a sow and litter can be let out for a run when the litter is two days old and this should be continued daily if possible for the whole of the suckling period.



A large container, holding → 10,000 gallons, for preserving curd.

TABLE OF APPROXIMATE FOOD VALUES

Standard food unit = 1 lb of barley meal = 1 gallon of skim milk

Food rich in protein	Food deficient in protein, rich in carbohydrates
One food unit =	One food unit —
(w) 1 gallon of skim milk	(w) 1½ gallons of whey
(w) 1 gallon of buttermilk	(c) 1 lb of maize or maize meal
(c) 1 lb of skim milk powder	(c) 1 lb of barley or barley meal
(c) 1 lb of buttermilk powder	(c) 1 lb of wheat or wheat meal
(c) 1 lb of meat meal	(c) 1 lb of pollard
(c) 1 lb of pea meal	(c) 1 lb of pig porridge
(b) 10 lb of leafy clover pasture	(c) ½ lb of tallow
(b) 10 lb of green lucerne	(b) 5 lb of potatoes (cooked), artichokes, sugar beet
(b) 10 lb of rape	(b) 7 lb of fodder beet
	(b) 10 lb of carrots, pumpkins, swedes, chou moellier, mangels

(c) = Concentrate supplementary feed; that is, high value, small bulk.
(b) = Bulky supplementary feed; that is, low value, large bulk.
(w) = "Watered concentrate"; that is, solids of high quality but bulked with excess water.

TABLE OF RECOMMENDED RATIONS IN FOOD UNITS PER DAY

Suckling Sows

4½ food units for the sow's maintenance.
1 food unit for each pig in the litter.

Litter in the Creep

From three weeks old, dry meal mixture ad lib. in a self-feeder.

Skim milk:

At the beginning of the fifth week: 1 pint each piglet in three feeds.

At the sixth week: 2 pints
At the seventh week: 4 pints
At the eighth week: 8 pints

Fattening Pigs

Liveweight	Approx. age	Food units
40	8	2½
65	12	3½
100	16	4½
120	18	5
140	20	5½
160	22	6
To slaughter date		no increase

All increases to be made gradually over the period.

Note: Farmers who possess properly insulated fattening houses in which the temperature can be satisfactorily controlled can reduce the rations fed to fattening pigs by ½ food unit per day. Pigs housed in good fattening houses of this type, if fed the full rations given above, would tend to be too fat.

The pasture must be good quality, leafy clover.

After weaning a daily run out is of great benefit in keeping pigs healthy. Even in the later stages of fattening a run out two or three times a week is good policy, though many farmers prefer to keep pigs totally confined for the last three or four weeks.

If it is not possible to let pigs out, a small quantity of green feed should be fed daily, silver beet or beet spinach being a very satisfactory crop. A small patch can be grown close to the piggery, the pig manure being of great assistance, and a handful of green feed fed to each pig daily. Fresh lawn clippings can also be used. Pigs cannot eat large quantities of this type of feed and only sufficient should be given for them to consume in about 15 minutes.

When sows and litters cannot be let out steps must be taken to avoid the onset of anaemia with its attendant scours. A sod of clean turf can be dug up and put in the pen when the litter is almost two days old or a simple, cheap, and efficient method is to throw a handful of sulphate of iron on the floor of the pen three times a week.

Summary

The production of pig meat on the home separation dairy farm is a very profitable sideline. By correct management and feeding of the skim milk a farm return of 8d. per lb of butterfat can easily be obtained; many farmers are achieving a higher return than this.

The essential points are:

1. That sows must farrow at a time of year that will fit the supply of pigs to the supply of skim milk. This means that farrowing must begin two and a half months before half the dairy herd will have been calved, and again six months later.
2. That a policy of producing baconers from the winter litters and porkers from the summer litters be adopted. In spring when the supply of skim milk is growing with the pigs they can be taken to bacon weight without the use of supplementary feed in the later stages of fattening, and in autumn when the supply of milk is falling the sale of pigs as porkers as soon as they are finished reduces the number of pigs on hand as the supply of skim milk becomes less.
3. That a concentrate supplement in the form of a meal mixture is used when the pigs are young, from the time they begin feeding in the creep until they are four months old. The pigs are therefore adequately fed during the period in which muscle or lean meat is developed rather than fat.
4. That pigs are not overfed in the final stages, but that feed is restricted to avoid the production of an overfat carcass that will fetch a lower price.

New Grades for Maple Peas

NEW grades for maple peas to operate as from and including the next harvest, which will begin at the end of 1960 or early 1961, have been agreed on with the United Kingdom purchasers, says the New Zealand Grain, Seed and Produce Merchants' Federation. One of the most important features is that the peas must be machine dressed.

Of the varieties of maple peas grown in New Zealand Partridge is still very popular overseas, but Marathon does not meet such a ready sale and overseas buyers have suggested that New Zealand should reduce its offerings of this variety.

Varieties have become badly mixed and this should be corrected by sowing pure lines of seed, field rogueing, and taking care to see that header harvesters are cleaned out between varieties so that the seed does not become mixed.

Samples of New Zealand maple peas are stated to be uneven, contain weed seeds, pods, earth, and other extraneous matter, and the sacks are of uneven weight. Because of these points, Tasmanian maples, which are machine dressed to even quality and packed uniformly, have commanded a premium of £5 to £6 per ton over New Zealand peas.

"It is essential, therefore," says the New Zealand Grain Seed and Produce Merchants' Federation, "that the quality of our peas be improved; otherwise we run the very definite risk of losing our valuable overseas markets to our competitors."

The new grades are:

No. 1 Grade (to be Machine Dressed)

Minimum size: 92 per cent to be over ¼ in. in diameter. 8 per cent tolerance down to 14/64ths in. in diameter.

Splits: Not to exceed 0.5 per cent.

Damaged and sprouted: Not to exceed 1.5 per cent.

Foreign matter: Not to exceed 0.5 per cent.

Conditions: Sound, dry, and in good keeping condition at time of shipment.

Colour: F.a.q. of the season and samples to be dispatched by first-class air mail to the London Corn Trade Association before 30 April of each year.

Moisture: Not to exceed 15 per cent.

No. 2 Grade (to be Machine Dressed)

Minimum size: 85 per cent to be over 13/64ths in. in diameter. 15 per cent tolerance down to 5/32nds in. in diameter.

Splits: Not to exceed 2 per cent.

Damaged and sprouted: Not to exceed 2 per cent.

Foreign matter: Not to exceed 2 per cent.

Conditions, colour, and moisture are the same as for No. 1 grade.

All percentages are calculated by weight.

Recent Research Work

IMPROVEMENT OF HILL COUNTRY PASTURES

A HILL country pasture improvement trial on a field scale was begun in July 1957 at Fordell, 12 miles from Wanganui. The normal improvement technique of topdressing and oversowing was compared with spraying with dalapon, topdressing, and oversowing. The merit of applying nitrogen was also investigated.

THE area selected for the experiment was a moderately steep, southerly face with a browntop dominant pasture containing sweet vernal, dogstail, a little cocksfoot, and annual clovers. The trial area was part of a fairly large paddock and because of being a southerly face it had been to a large degree neglected by stock. The paddock had no previous topdressing and was in an unimproved state with manuka invading the sward.

At the beginning of the trial the southerly face on which the plots were situated was fenced off from the rest of the paddock to permit good grazing management and to facilitate mob stocking during the trial. Soil tests taken in October 1957 gave a pH of 5.7, a calcium level of 7, a medium to high potash level (8), and a low phosphate level (1). The hill face was pegged off into three one-acre plots which were given the following treatments:

PLOT 1

Sprayed with 5 lb of dalapon and sown with 30 lb of grass and clover seed 13 weeks after spraying.

Topdressed with (a) 1 cwt of sulphate of ammonia 15 weeks after spraying and (b) 3 cwt of superphosphate 17 weeks after spraying.

PLOT 2

Sprayed with 5 lb of dalapon and sown with 30 lb of grass and clover seed 13 weeks after spraying. Topdressed with 3 cwt of superphosphate 17 weeks after spraying.

PLOT 3

Oversown with 30 lb of grass and clover seed and topdressed with 3 cwt of superphosphate. **No dalapon or nitrogen was used on this plot.**

The seeds mixture used was 20 lb of perennial ryegrass, 4 lb of cocksfoot, 2 lb of crested dogstail, and 4 lb of white clover, giving a total of 30 lb per acre.

The 5 lb of dalapon per acre in the first two plots was applied as a spray in 13 gallons of water by a helicopter using a 23 ft boom with 42 tee jets. The helicopter flew at 27 miles per hour and covered the trial area in three runs. The spray coverage was not particularly good; three strips across the plots received very little spray.

Weather was ideal at the time of spraying, but the condition of the pasture was not particularly suitable because rank browntop occupied a considerable portion of the plots. The remainder of the area was closely grazed.

EFFECT OF SPRAYING

There was a limited amount of cocksfoot in the pasture and this was the first grass to die off after spray treatment. It was three to four weeks before the rank browntop began to die off and six to eight weeks before the pasture was open enough for oversowing. The area was not oversown, however, until 13 weeks after spraying, partly because of the unavailability of the helicopter and partly because of possible germination injury from a heavy population of slugs in the decaying vegetation.

The pasture on the trial area was point analysed in October 1958 to measure any changes in pasture composition that had taken place as a result of the treatments. A previous point analysis had been taken at the beginning of August 1957.

PLOT 1

Dalapon + sulphate of ammonia + superphosphate and oversowing: There was a reduction in the amount of browntop in the sward and individual browntop plants were less matted. White clover entered the sward strongly and became one of the major components. Ryegrass and sweet vernal increased and there was a slight increase in cocksfoot and crested dogstail.

PLOT 2

Dalapon + superphosphate and oversowing: More ryegrass entered the sward than in plot 1. White clover again established strongly. There was an increase in the amount of sweet vernal and a small increase in danthonia and crested dogstail. The amount of cocksfoot recorded was slightly less than in the original sward.

PLOT 3

Superphosphate and oversowing: White clover established at least as well as in the first two plots. There was only a small increase in the amount of ryegrass and no increase in crested dogstail or cocksfoot. There was a considerable increase in sweet vernal and a small increase in danthonia.

The pasture on the three plots appeared very similar on visual observation and all plots were better than the surrounding pasture. The biggest factors in improving the pasture in this particular case were topdressing with superphosphate and oversowing with 4 lb of white clover, which was included in the general seed mixture. The fencing off of the southerly face permitted good pasture management and allowed the full benefit from the topdressing and oversowing to show up. There was no benefit from topdressing with 1 cwt of sulphate of ammonia.

Unfortunately, there was too great a lapse of time between spraying and oversowing and this allowed the partially killed weed grasses to reinfest the pasture. The rate of dalapon (5 lb per acre) was not sufficient to give a complete kill of the existing turf on either the closely grazed or rank portions of the pasture. The kill of turf was, however, relatively better on the close grazed areas.
—*A. A. DUNCAN, Farm Advisory Officer,*
Department of Agriculture, Wanganui

TYPES OF GLASSHOUSE

There are three main types of glasshouses:

At left—Gable roof glasshouse with side walls up to 3 ft and low glazed sides to eaves. This is suitable for pot plants and plant propagation.

Lower left—Lean-to glasshouse, usually with a low foundation wall. This is suitable for both types of plant culture.

Lower right—Gable roof glasshouse glazed almost to the ground. This type is good where plants are to be in the ground, such as carnations or succulents. Many prefabricated glasshouses are of this type.

A Glasshouse in the Flower Garden

By J. P. SALINGER,
Horticultural Advisory Officer (Ornamentals), Department of Agriculture, Wellington

INTEREST is increasing in the construction and use of glasshouses in the flower garden both for propagating plants and for growing plants for ornament. A glasshouse is essential for gardeners specialising in plants such as orchids, and the more tender plants like begonias, while it can also provide flowers and foliage for decorating the home during winter.

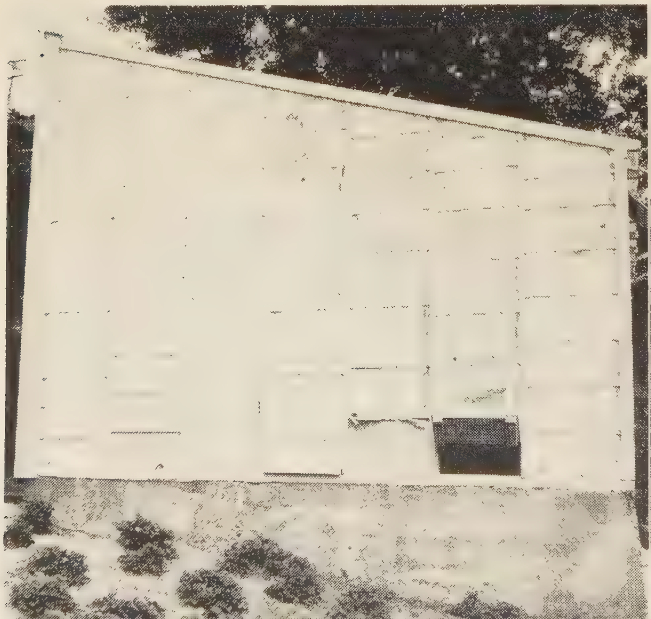
BEFORE building a glasshouse the gardener should decide whether it is to be solely for propagating, for growing a range of plants, or for cultivating specific types such as carnations, succulents, and orchids. Possibly the house may be used to grow some grapes or tomatoes in summer as well as flowers, though this is not particularly desirable, as the cultural conditions for the two types of crops are somewhat different.

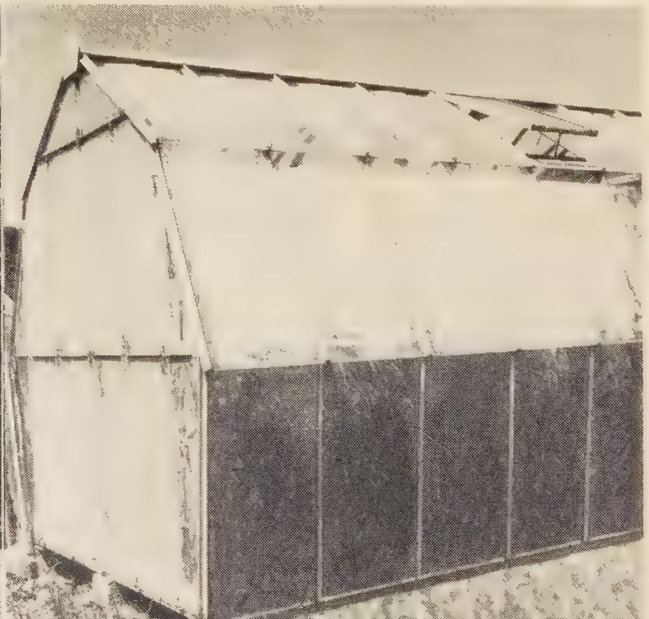
Usually it is better to have a house which can be used for various purposes, as though in the beginning the gardener may specialise, he frequently becomes interested in a wider range of plants.

A gable roof glasshouse should have the ridge running north and south or north-east and south-west. If a lean-to house is constructed, the longest glazed side should face north. In many gardens there may be only limited areas where a house can be built. The glasshouse must be away from trees or buildings which throw shade from the north or east. In windy areas it is advisable to provide shelter, particularly to the south and possibly to the north. To the north trellis or a hedge can be set some distance from the glasshouse and not higher than the eaves of the glasshouse. The ground where the house will be placed need not be level, as this can be overcome by suitable foundations. The soil inside the glasshouse, however, should be level. If the ground is much higher at one side of the site, it is advisable to place a drain between this higher land and the wall of the glasshouse.

Probably the lean-to glasshouse is the cheapest and easiest to build, if there is a suitable back wall such as a garage or potting shed. Temperature and humidity tend to change more rapidly in a lean-to glasshouse and for general purposes gable roof types are more satisfactory.

Construction of gable roof and lean-to glasshouses is given in Depart-





ment of Agriculture Bulletin No. 373, "Glasshouse Construction" (1s. 6d.).

A very simple glasshouse with limited use can be made from second-hand material such as windows and glazed framings. It is advisable always to fix a gutter and spouting to a glasshouse to keep the foundations dry and prevent water seeping into the house.

Main Requirements

A glasshouse is built to protect plants from wind, heavy rain, frost or snow, intense heat and sun and should provide a more equable and suitable climate for the plant. To achieve this light, ventilation, heating, and water are required.

It is most valuable if electricity can be provided to the glasshouse for heating and for light for working in winter.

Light

The house should be painted both inside and out with white or aluminium paint to get the greatest reflection of light in winter. In summer, on the other hand, shade will be required. Permanent materials such as blinds made of laths fixed either inside or outside can be used or shading can be temporary by painting the glass with whiting or similar materials, or black polythene may be attached in strips to the inside of the glazing bars.

Ventilation

Ventilation is most important at all times, but especially in summer. Usually the vents are placed at the ridge, but this can be improved by placing vents also at the base where there are low glass sides or at the eaves with high glass sides. Additional ventilation can be obtained by having vents at the ends and for this purpose louvres are most useful.

Where the gardener cannot alter the ventilation during the day an extractor fan fitted at one end of the house will assist, especially if it is operated by a thermostat.

If a door is left open for ventilation an insect-proof screen in the door frame is advisable to keep out animals and insects.

Heating

Depending on the location of the house and the types of plants grown, heating will be required in winter to be almost continuous or to provide against frost. Hot water heating is seldom used now, as electric heating is convenient and efficient, and kerosene heaters provide frost protection.

Probably the cheapest method of heating is to use a combination of kerosene heaters and electricity, using electricity to provide an even temperature and kerosene heaters for additional heating in really cold weather.

Many of the plants grown in glasshouses are almost hardy and only need frost protection, with a minimum temperature of 40 degrees F; in sunny areas in warmer parts continuous heat is seldom required.

However, for propagation of plants from seeds or cuttings temperatures of 60 to 70 degrees F are desirable. A part of the bench area can be set aside and if necessary boxed in and covered with a glass or plastic frame light. Heating to this part is best supplied by low voltage galvanised wires attached to a transformer, the loading being between 7 and 10 watts per square foot. Alternatively high voltage plastic covered cables of definite lengths for a specific area of bench can be laid down to give the same loading. The cables should be laid in damp sand, gravel, or scoria, allowing 2 in. of medium above and below the cable. The pots or boxes are then placed on this.

Interior of gable roof glasshouse with orchid plants on benches. Heating is provided by high voltage cables buried in the bench and controlled by the thermostat on the end wall. Additional heat can be provided by tubular heaters beneath the bench. Rattan blinds are used for shading inside the glasshouse.

▼ Plants in the propagation section. Young orchid plants are in small clay pots plunged in sphagnum moss to maintain humidity. Cuttings are rooting in a pot enclosed in a plastic bag. In the white bowl, begonia tubers have been placed in moss to start growth.

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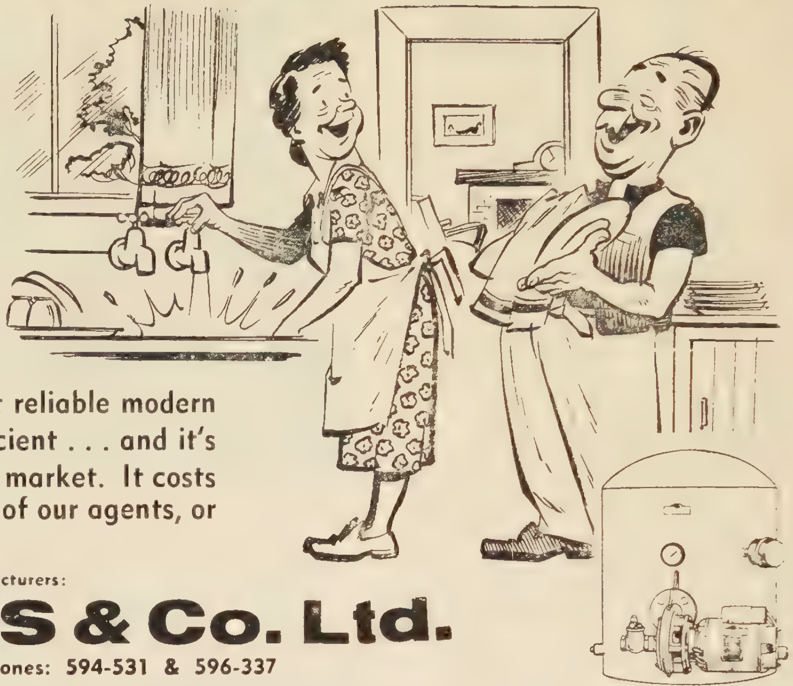

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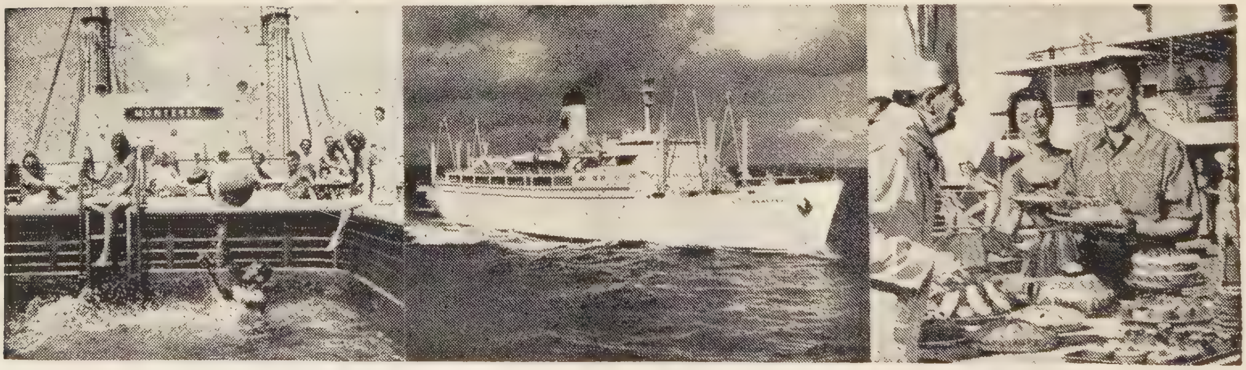

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Atmospheric heating on a permanent basis by electricity can be carried out by having "Pyrotenax" cables fixed on framework to the side walls or under the benches, by tubular heaters, usually 60 watts per foot run, attached to the walls or bench supports, or by fan heaters, usually of 1 or 2 kilowatts. The wiring of these heaters should be thoroughly waterproof. All electric heaters are most economical if thermostatically controlled.

Before electric heating is installed the electricity supply authority should be consulted. All mains wiring must be carried out by a registered electrician.

In all glasshouses heat loss can be reduced without affecting light transmission by lining the interior of the glazed sides and part way up the roof with clear or white polythene sheets of .0015 in. gauge. The sheets should be attached to timber members with staples or drawing pins and with a cardboard "washer" between these and the sheet. In metal constructions it is advisable to fix wooden laths to the members and fix the sheet to the laths.

Water

An adequate water supply is necessary. A stand pipe from the main is best actually in the glasshouse, as such water is never too cold for glasshouse use. Alternatively rain water can be collected from the roof and stored in a tank in the house with an overflow leading outside or a small tank should be kept in the house.

It is not convenient to enter and leave the glasshouse frequently to draw water from outside. If the water is from an artesian bore, it may be too cold and it is advisable to run the water into a tank in the glasshouse to allow it to reach the temperature in the house before use. Tanks in the glasshouse should be so placed that they can be emptied easily and cleaned out regularly and should be covered to keep out plant leaves and other rubbish.

Paths

Paths should be of a dry, firm material, preferably concrete, but reinforced metal flooring or a layer of shingle is also satisfactory.

Frames

A few frames outside both on the sunny and shady sides of the glasshouse or standing apart are a useful adjunct to the glasshouse. If fitted with glass and shades of laths or scrim, they can be used for hardening off plants in spring and for growing or ripening off plants in summer; in autumn pots of bulbs can be plunged in them before being brought into the glasshouse to flower.

Growing the Plants

Most plants will be grown on benches in the glasshouse; a few grow better planted in the soil or in specially made-up beds. This applies particularly to carnations and the larger succulents and gerberas in the coldest areas. A few permanent plants like lapageria and hoya grow better when planted in the soil and even if the house has benches, provision can be made to lead the main stems up through the bench.

Most gardeners wish to grow as many plants as possible in their glasshouses so benches may be placed at various levels. It is advisable to have one wide bench at a height of 2 ft 8 in. to 3 ft where plants can be propagated or groups of plants grown in the same conditions. Additional space can be provided by having other benches in tiers and even by having narrow benches at one end and a single bench suspended from the ridge if the house is high enough. Alternatively, hanging baskets may be suspended from the roof.

Benches should be of solid materials and if they are permanent, the supports can be of metal or of timber set on concrete. Benches are frequently of slats, but growing conditions are better with a material such as asbestos sheeting surfaced with shingle or scoria or similar materials. Provision should be made to drain such benches.

Consideration could be given to making a small part of the bench a permanent plunging area for pot plants. For this a low wall of a single layer of bricks set on edge can be built on the bench and filled with sphagnum moss or peat and the pots plunged in this material. This method reduces the watering required.

The space beneath the benches is suitable for Rex begonias, maidenhair fern, selaginella, and other shade-loving plants.

ROUTINE MANAGEMENT

A glasshouse grower aims to obtain a good "buoyant growing atmosphere", which it may be said is one which is comfortable for human beings to work in; for instance, a cold damp atmosphere in winter or hot, dry air in summer is unsuitable both for plants and the gardener. The ideal conditions will only be achieved by a combination of heating, watering, ventilation, and shading. For instance, in sunny weather even in winter the temperature of a glasshouse will rise appreciably and this will tend to stimulate growth. As a high temperature is not desirable in the glasshouse at this time, a little ventilation on the leeward side of the glasshouse may be needed.

Spring

In spring the winter flowers will be passing their best and most plants making new growth. The glasshouse will probably be full of boxes of germinating seeds and seedlings. Conditions can be variable with a bright sunny day followed by a cool, frosty night or the weather may be grey and humid. Where a range of plants are being grown it is best to divide the glasshouse into sections for propagating, growing-on, and drying off.

The propagating section should be in a warm, shady part, as seeds and tubers such as gloxinias mainly require warmth and moisture and little light. Once the seeds have germinated they may be moved to the growing-on part, though immediately after pricking-off they will need to be shaded for a short period. Similarly the tubers will need more light as the shoots develop.

All permanent pot plants which have been overwintered will be placed in the growing-on area. Woody plants such as fuchsias which have been cut back will be making new growth on the older wood and most foliage plants will also be growing away. All these plants require maximum light, a fair amount of water, and only a moderately warm atmosphere. During late spring these and other plants will require repotting either into the same sized pot with fresh soil or into larger pots. The plants should be shaded for a few days after repotting.

In the drying-off section, which is a small part of the glasshouse in the warmest drying position, probably at the north end, plants such as cyclamen, freesias, and hyacinth should be placed to complete their growth before they are placed outside or in a frame. If frost is expected, a stove should be lit or the electricity switched on before the house temperature falls too low; normally when it is at 45 degrees F.

Summer

In summer the temperature in an unshaded glasshouse will be very high. At such times the atmospheric conditions are improved by shading, adequate ventilation, and damping down by spraying the benches and paths with water as well as watering the plants.

Plants are growing vigorously and so require regular and frequent watering. They will also need to be moved from one bench to another as they grow to allow each plant sufficient room and to place those plants which require more shade and cooler conditions in the coolest part of the glasshouse, normally the south end.

Watering can never be a routine operation and the best way to tell whether a plant requires water is to lift the pot. If it feels proportionately light in weight, water is required. If it feels very heavy, it will not require water and the pot drainage may be blocked.

Quick growing plants or plants with heavy flower heads such as primulas or begonias will require neat and careful staking. Dead heads and old

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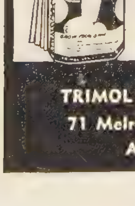

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leaves should be removed and taken from the house. The ventilators can be left open night and day unless the weather is cold.

Pests, especially aphids and red spider mite, can build up quickly and should be promptly controlled by insecticides in aerosol form or as smoke fumigants.

Fungous diseases such as grey mould (botrytis) indicate that conditions in the glasshouse are too damp and cold. Damping down should be reduced and a slightly drier atmosphere maintained.

Diseases such as powdery mildew are more prevalent under hot, dry conditions and these can be overcome by more frequent damping down and by additional shading and ventilation.

Plants will require regular feeding and soluble fertilisers or liquid manure are best, but should be used only when the soil is already moist.

Autumn

In autumn plant growth will be slowing down. The weather may be warm, but frosts can be expected in bright, clear weather.

Temporary shading should be gradually removed.

Plants will still require water, but less than in summer and less damping down will be required.

Feeding should be reduced and then stopped completely. Plants such as primulas and cyclamen and winter-flowering begonias which are expected to flower should gradually be brought to a sunny part of the glasshouse and plants which are becoming dormant may be placed in a more shaded position.

Plants such as carnations which are raised from cuttings taken late in spring should gradually be given more light and will still need regular watering, as they will continue to grow during winter.

Autumn is not a good time for sowing seeds in the glasshouse. It is best to wait until late winter or spring.

If it is possible, on a fine day the house should be cleared of plants and the whole of the interior thoroughly washed down with a dilute formalin solution—1 pint in 5 gallons of water—and then washed with clean water. Many fungus spores will be eradicated and the house can be cleaned generally.

Every effort should be made to ensure that the plants when returned to the glasshouse are free of pests and diseases. Old flower heads and yellowing leaves should be removed, the outside of the pots scrubbed free of algae and moss, and the soil surface lightly worked up. The surface material on the benches should be raked over and added to, if necessary. The water tank should be emptied and cleaned out.

If plants are grown permanently on the floor of the house, it will be possible only to scrub the house down. A household detergent should be added to the water and the plants covered with sacking or similar material.

Winter

During winter, with cooler temperatures and less light, plants will be growing slowly. Watering and damping down, if required, should be done in the early part of the day so that the atmosphere is drier by the evening. Some ventilation will still be required on warm sunny days on the leeward side or through the end ventilators.

The heating system should be checked regularly to see that it is working satisfactorily; kerosene heaters should be kept clean.

Flowering plants should be placed in the sunniest part of the glasshouse and can be brought into the home. When returned to the glasshouse they should be placed in a more shaded place until they have again become accustomed to glasshouse conditions.

Seeds of plants which require a long growing period should be sown in July or August for pricking off in spring.

Garden Work for August

As the days become longer and warmer many more shrubs come into bloom.

Evergreen and frost tender shrubs and trees can now be planted, as the soil is beginning to warm up. If the soil is still cold and wet, it is better to delay planting, particularly on a clay soil; plants may be heeled in until the soil is workable.

The ground should have been prepared at least a month in advance to allow the soil to settle again. During the preparation weeds are removed and compost or leaf mould incorporated.

By JOY WATKINS,
Horticultural Advisory Officer,
Department of Agriculture,
Auckland

Before planting in positions where trees or shrubs have died and been removed it is advisable to treat the soil with copper oxychloride at 1 lb to 5 square yards to reduce the risk of fungous diseases infecting the new plants.

Replants of the same type of tree or shrub are often unsatisfactory.

Herbaceous Plants

Herbaceous plants can be propagated now. In colder districts or on heavy soils it is better to lift and divide these plants in early spring, as small divisions made in autumn are likely to suffer from cold and wet in winter before they have made much new root growth. The soil should be enriched with compost, manure, or leaf mould before replanting. Do not propagate from any plant unless it is vigorous and healthy.

As the shoots of herbaceous plants begin to grow in spring, many can be used as cuttings. They should be removed with a sharp knife when 3 or 4 in. long, being cut just below a leaf or bud and any bottom leaves removed. Those with hollow stems (delphinium and lupin, for example) should be taken with a heel of old wood attached. All types root more readily if the basal portion of the stem cutting was growing below ground before removal. Cuttings should be inserted in a light, sandy soil in a pot or frame and watered in. The atmosphere must be kept moist to reduce wilting by keeping the frame closed or enclosing the pot in a plastic bag until the cuttings are rooted.

Cuttings consisting of small portions of the thick fleshy roots of such plants as gaillardia and oriental poppy will produce new shoots if inserted in sandy soil and kept damp. Most root cuttings grow successfully if placed horizontally and covered with their own depth of soil.

Of the bulbs, freesias and sparaxis are now in full flower and make excellent cut flowers. Modern freesia varieties are much better than the old types and it is surprising that more are not grown, and they have a wide range of colours, long firm stems, and larger, less delicate flowers, which last a long time when cut. In the colder districts these bulbs should be planted in a warm, sheltered position in well drained soil. After flowering, do not cut back the leaves, as these make the food which will produce next year's crop of flowers.

Gladioli and other summer-flowering bulbs may now be planted in all districts. In the hotter and drier parts early planting is of particular value, as the flowers will be well developed before thrips become very active from the end of November. Gladioli are very susceptible to thrips damage, which causes distortion and browning of the flower spike, and a silvery-brown discolouration of the leaves.

Dusting the corms with DDT before planting will kill any of these pests in the early stages. Thiram dust can be added to protect corms from fungous diseases. Spraying with DDT 50 per cent wettable powder at 1 oz

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in 4 gallons or lindane emulsion at ¾ fl. oz. to 4 gallons of water every three weeks throughout the growing season will help to ensure that the plants remain free of thrips. When planting avoid hot, dry positions such as against the north wall of a house, as thrips multiply rapidly under such conditions, but do not plant in deep shade or the flower spikes will not develop.

The soil should be well drained and enriched with compost and 4 oz to the square yard of a mixture of 3 parts of blood and bone, 2 parts of superphosphate, and 1 part of sulphate of potash. Plant at 4 in. deep and 6 in. apart.

Sowing

Many annuals can be sown as soon as the ground is sufficiently dry and friable. Heavy clay soils which have been dug over roughly during winter can be broken down to a fine tilth with a fork. Such soils are most easily worked when they are drying after rain. Clods allowed to dry too much set hard and should be left until rain softens them. An application of lime immediately after digging in winter will often improve a clay soil.

If seeds tend to rot or to be damaged by soil pests, they should be dusted before sowing with thiram and lindane. A small pinch of each shaken up in a packet of seeds is sufficient. Too much of either is likely to retard germination.

Pruning

Prune peach, luculia, poinsettia, and similar winter-flowering shrubs, cutting back the branches which have carried the flowers to two or three good buds from the base.

Rose pruning should be completed and the bushes sprayed immediately with bordeaux mixture at 6½ oz of bluestone and 5¼ oz of hydrated lime in 4 gallons of water to protect the pruning cuts from fungal infection. Bordeaux mixture at this strength should not be applied to bushes which have tender young shoots, but only to dormant plants.

Glasshouse or House Plants

As the nights become warmer growth of pot plants increases and those plants with roots which emerge from the drainage holes at the bottom of the pot have completely filled their pots and can be repotted. Most pot plants grow better if they are kept in the smallest pot commensurate with their top growth.

Plants which have filled their maximum-sized pot can be kept growing by watering with a proprietary liquid feed every two or three weeks during summer. Alternatively use sulphate of ammonia, dried blood, or blood and bone at 1 teaspoon to a gallon of water.

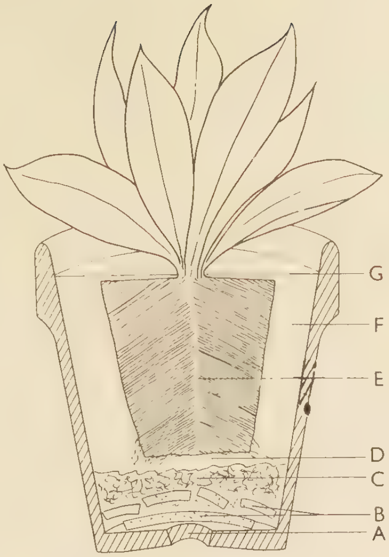

Diagram of potting on a house plant. A—Drainage hole. B—Crocks placed concave side downward over drainage hole. C—Moss, scoria, partly decayed leaves. D—Fresh potting mixture firmed down. E—Ball of roots knocked out of smaller pot and the crocks removed and basal roots loosened. F—Fresh potting mixture pressed down with a stick until it is as firm as E. G—Soil level allowing watering space.

Many plants, such as maidenhair fern and African violets, grow better when root-bound, that is, when the ball of soil in the pot is full of roots. The surface ½ to 1 in. of soil in the pot can be removed with a pointed stick when it becomes sour and greenish and replaced with fresh potting soil. Potting soil should be damp but not wet when used, and it should be of a sufficiently open texture to allow water to drain freely through it, but have enough organic matter to keep it damp for a reasonable period.

Rotted turf, prepared as described on page 410 of the April 1960 "Journal", should be mixed with coarse river sand, scoria, pumice, or similar drainage material, and leaf mould, peat, or compost in the bulk proportions of 3 parts of turf : 1 part of leaf mould : 1 part of coarse sand, though more or less sand can be used according to the texture of the rotted turf. Four ounces of a balanced fertiliser mixture and ¾ oz of lime should be added to each bushel (apple case) of soil mixture, which is turned several times with a spade to mix all the ingredients thoroughly.

Potting

Place scoria or broken pieces of clay pot over the drainage hole at the bottom of the pot. Cover these with coarse leaf mould or moss to prevent blockage of this drainage material. Add a little soil mixture and then place the small plant in the pot, adding and pressing down more soil mixture round it.

The new soil must be packed as firmly as the old ball of soil round the roots; otherwise water will pass quickly through the loose soil without wetting the central firm mass in which are the roots.

The surface of the soil should be level to provide for even watering throughout the pot, and it should allow sufficient space above so that when filled to the rim of the pot with water there will be enough to wet all the soil in the pot. This space is therefore about ¼ in. in a very small pot up to ½ in. in a 4½ in. pot.

The plant should be at the same level in the soil as it was previously. Deep planting may cause rotting of the crown of the plant, while very shallow planting will expose some roots, which will dry out and die.

When a plant is to be potted on (transferred from a small to a larger pot) it should be removed from the original pot by tapping the rim on the edge of a bench, supporting the plant and ball of soil with the first two fingers. Carefully remove drainage crocks and loosen the mass of roots at the base before potting as detailed above.

Newly potted plants should be watered and then placed close together in a warm, shaded part of the glasshouse. As they begin to grow they can be spaced out so that the leaves are not touching. A damp atmosphere is beneficial if it is also warm, but **cold**, damp conditions encourage the development of diseases such as botrytis which can rot the leaves and crowns.

Begonia and gloxinia tubers which were started into growth last month should be growing away well. Be careful not to water too frequently, as the roots are susceptible to rotting from overwatering.

Ventilation and watering should be increased as the days become warmer, but care should be exercised, as sudden cold spells can check the growth of plants, particularly those which are in the seedling stage, and those which prefer warm conditions, for example, African violets and gloxinias.

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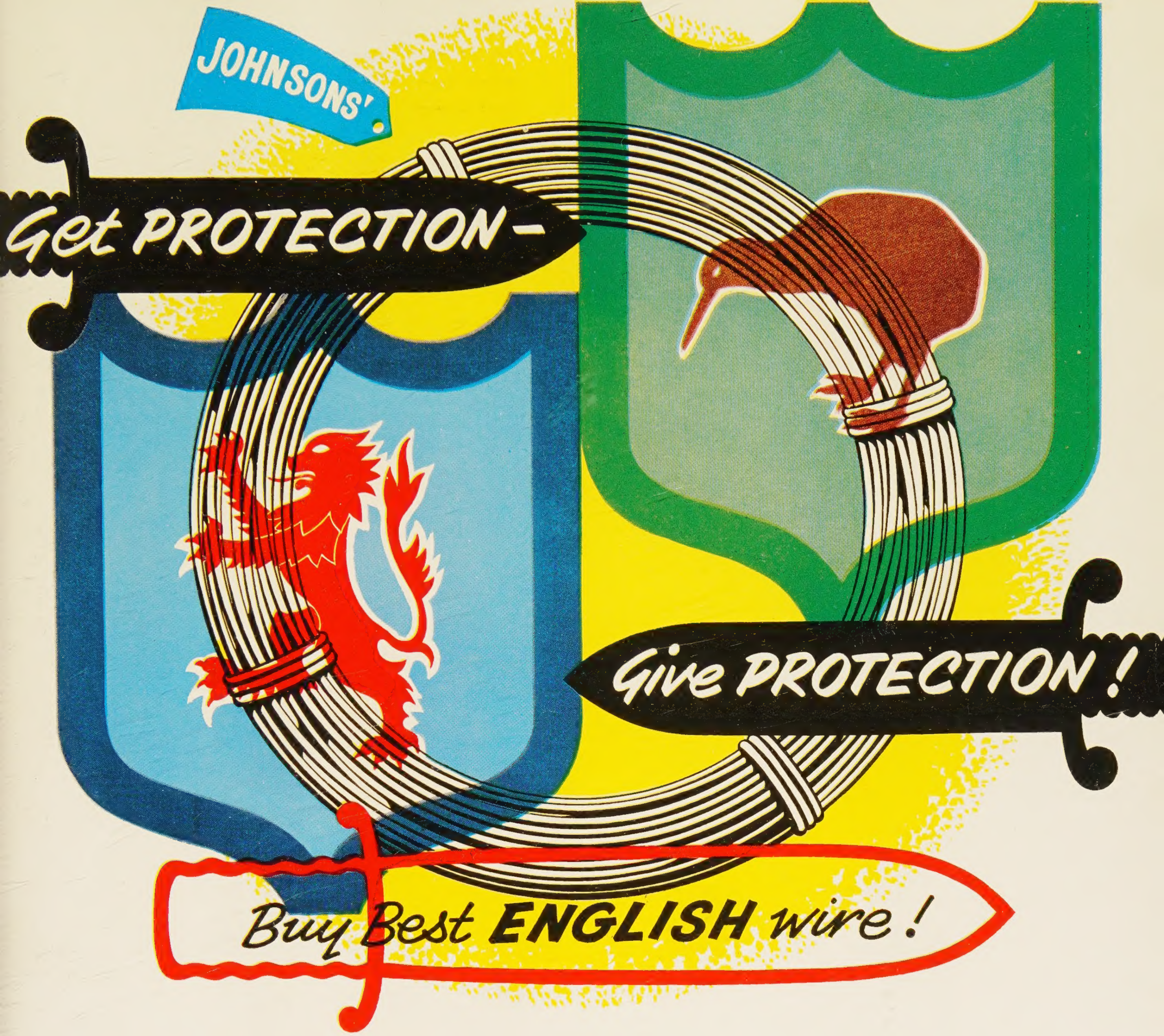
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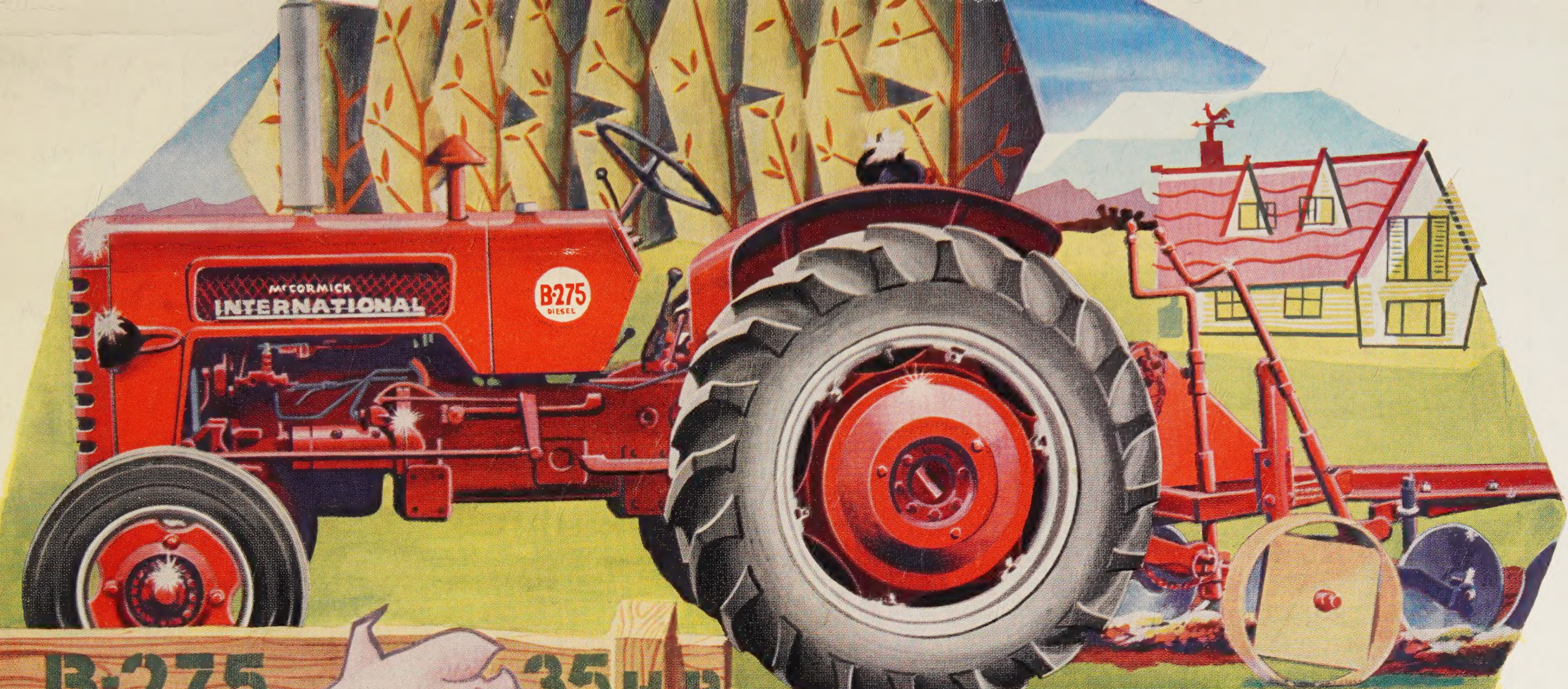

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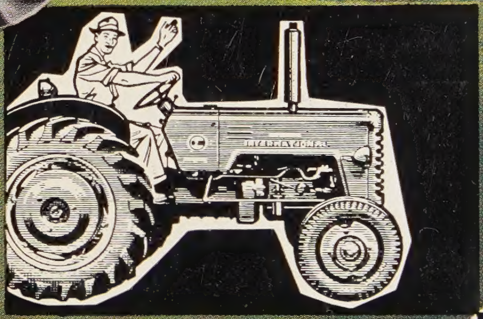

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